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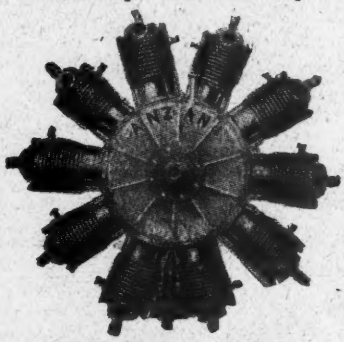

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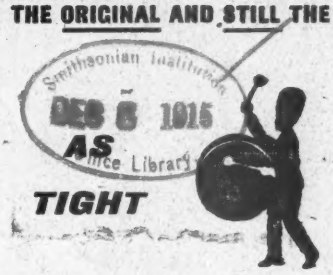

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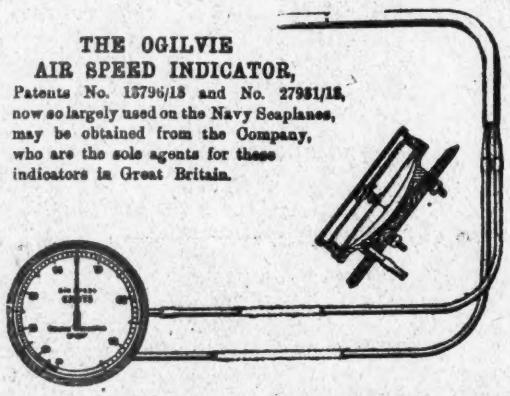

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EDITORIAL COMMENT.

Who Said Party Politics were Dead?

There is a theory around that for Great Britain and its Government, politics are for the time but a buried memory—interned for the period of the War. With a great proportion of the people of our Empire, and in the case of the majority of the leading politicians, there is little doubt that this truce is being honourably observed. A small minority, unfortunately, appear to take the view that the truce is opportune for subtle but vicious attack of those whom they have reason to think may stand in the path in which their ambitions lead them, with the result that all sorts of underhand machinations are at work to upset this or that personage, with little regard to the ultimate welfare of the nation. In this way it comes about that men who have been and whose services still are most invaluable to their country have to sacrifice themselves or be sacrificed so that the wheels of Imperialism may run along without even the semblance of a faulty cog in their periphery. That there have been mistakes and halting by the way, where instant and masterly decision might have had the most far-reaching benefits, there is hardly room to doubt. That any such mistakes would necessarily, under all the outstandingly abnormal conditions, have been avoided by others who might have been called upon to make choice at some highly critical moment is not necessarily a foregone conclusion. Showing how the thing *should* have been done after an event has worked itself out, or in city parlance "jobbing back," is one of the most popular forms of criticism which the professional seeker after fame has to his hand. And in most cases he does not scruple to utilise his opportunities with the most destructive effect, seldom having himself the germ of an idea so far as constructive criticism might lead a way out of the tangle which it pleases him to hold up to scorn. He is satisfied if his thrust gets home, especially when the surroundings of the incident preclude any real explanation being at the moment given. In some instances official scruples are thrown to wind, an effective counter-stroke is made, plus resignation, and another good man has gone by the board at the instigation of a set of men who probably know little or nothing of the real facts of the case which have led up to the situation. We, who are unconcerned with all these abominable political strategic moves, can only regard such tactics with disgust. There is at least hope, however, that in the days to come, when, the facts as then revealed, full tribute can be paid to those who have endeavoured to uphold the Country's welfare and prestige, the attackers of to-day may be turned into suppliants for re-instatement into public favour for their ill-judged heckling of men of moment whose hands for retaliation have been in the past firmly tied behind their backs by the binding obligations of their office. It is not a matter of single cases. There are, unfortunately, several which have taken effect.

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And Mr. Winston Churchill.

Although in somewhat a different category to this position, we cannot help but deplore the retirement of Mr. Winston Churchill, who has, without doubt, taken this step in protest to the snarlings of the few malcontents who are ever on the alert to upset men in power who in their mind they probably place in the category of rivals to their own fame and advancement. We regret this secession from the Government irrespective of whether Mr. Churchill can be held responsible for any past unfortunate moves in the War or the reverse. He may or may not have judged consequences rightly. Whoever has been responsible matters little *now*. Any ill results not only *have* to be

but *will be* retrieved by us in the long run, and there will be plenty of time for the apportionment of the blame when the war is a thing of the past. It would have been better, we consider, had Mr. Churchill stuck to his Leader in spite of the attacks upon his actions. His resignation was too great a sacrifice for the obtaining of an opportunity of justifying himself at the present moment in the eyes of the country. Work and very vital work would then have been ready to his hand in the form of taking a hand in the still greater furtherance of our Air Services.

His past activities and support of this our youngest arm is well known to all those who have taken the trouble to follow the at first very slow, but subsequent phenomenal, growth of naval and military aviation. From early days Mr. Churchill took the keenest and most personal interest in the great air power which was then being born, and, supported by a few far-seeing Navy and Army enthusiasts, every effort was put forward by him to bring his colleagues in the Cabinet into line with his own views of the future of this now vital arm of our forces. Not only did he force forward the requirements of Service aviation, but it was largely due to Mr. Churchill's energy that the Armoured Car Squadrons which were linked up with the R.N.A.S. were brought into being. That they have done most admirable work in this present war wherever opportunity has offered is world knowledge Now, and when once stale-mate trench warfare takes a vacation, we may confidently look forward to the resumption of their telling work with our armies. It was but a fitting tribute to the late Minister's great work in this connection, that the officers of the Armoured Car Squadrons should have deemed the occasion of his retirement a suitable opportunity of expressing *their* views of his genius by the presentation of his portrait in oils by Mr. John Lavery to Mr. and Mrs. Churchill in memory of his connection with that force and his devoted efforts on their behalf. Whether it is advisable or practical to create a Minister of the Air, as has been widely suggested from the most varied and mysterious quarters, and nominate Mr. Winston Churchill as the first occupant of that important Cabinet post is an arguable point and for the present beside the question. In like manner to the creation of the Minister of Munitions, Mr. Churchill, however, should be an invaluable national asset just now were he to be joined up in this connection with the Munitions Minister, to take in hand the supply of all things aviatic. There is an ever-increasing field for his energies in this direction in such a helpful way that need not interfere with the present splendid efforts of those in charge. The appointment should be such as to greatly strengthen and consolidate those efforts and enable this country to be, by the spring time, in an even more unassailable position in regard to mastery of the air than we hold at present. The late Minister's heart is in the work, and we sincerely trust that some *modus operandi* may be opened out whereby his great talents may be brought into play Imperially in connection with the ever-spreading fifth arm of our Defences.

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THE ROLL OF HONOUR.

THE Secretary of the Admiralty has announced the following casualties:—

Previously reported Missing, now Officially reported a Prisoner of War.

Flight-Lieutenant Lionel D. McKean, R.N.
(Assistant Paymaster, R.N.).

Previously reported Missing, now Unofficially reported Wounded and Prisoner of War.

2nd Grade Air-Mechanic H. G. Shields.

Under date October 18th:

Drowned.

Flight Sub-Lieutenant John T. Bone, R.N.

Under date November 7th:

Injured.

Flight-Lieutenant Harold F. Towler, R.N.
Flight Sub-Lieutenant Frank S. McGill, R.N.

The following casualties in the Expeditionary Force have been officially reported from General Headquarters:—

Under date November 4th:

Wounded.

Second Lieutenant L. J. Bayly, Royal Garrison Artillery, attached R.F.C.
Second Lieutenant C. C. Miles, Royal Flying Corps.

Missing.

Second Lieutenant A. W. Brown, 3rd Manchester Regt., and R.F.C.
Second Lieutenant H. W. Medlicott, Royal Flying Corps.

Under date November 5th:

Wounded.

Captain C. E. Ryan, Royal Field Artillery and R.F.C.

Missing.

Second Lieutenant J. B. Robinson, Royal Flying Corps.

Under date November 8th:

Killed.

Lieutenant G. F. Harvey, Royal Field Artillery, attached R.F.C.
Second Lieutenant W. J. McConnochie, Royal Flying Corps.

Missing.

Captain T. D. Adams, R.F.A., 1st W. Lancs Brig. (T.F.), attached R.F.C.
Lieutenant O. V. Le Bas, R. W. Surrey Regt. and R.F.C.

Undated:

Prisoner of War.

Second Lieutenant A. L. Burnie, 8th East Kent Regt., attached R.F.C.

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The Death of Col. Fulton.

IT is with the greatest possible regret that we have to record the sudden death on the 11st inst. of Lieut.-Col. J. D. B. Fulton, C.B., R.F.A., who, after occupying the position of Chief Inspector in the Aeronautical Inspection Department from its inception, had but a few days before been appointed assistant director of military aeronautics. Col. Fulton's death is a very heavy loss not only to aviation but to the nation, as, apart from his brilliant military career, he fought in South Africa and received both medals and eight clasps; he was a pioneer in aviation. His pilot's certificate was No. 27, and dated November 15th, 1910, the qualifying tests having been made on a Farman biplane on Salisbury Plain, although Col. Fulton had previously taught himself to fly on a Bleriot monoplane. He served in the original Army Air Battalion, and passed into the Royal Flying Corps on its formation, subsequently going to the Central Flying School as an instructor. Returning to the Royal Flying Corps at the end of 1913, he was appointed chief inspector, and on the establishment of the A.I.D. last year was placed in charge of it.

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AT HENDON—A STRANGER MAKES A "COURTESY" CALL.—The machines in the air are: top, Vickers scout flown by Mr. Harold Barnwell; and below, a Grahame-White biplane. Inset at the top, left, is the Vickers scout with its chassis heavenwards, during one of the loops which it made upon its "courtesy" call at Hendon, and to which reference was made in "Eddies" and Hendon Notes last week.

AIRCRAFT WORK AT THE FRONT.

OFFICIAL INFORMATION.

Italian.

Rome, Nov. 10th.

"YESTERDAY our aircraft bombarded the railway stations of San Daniele and Nabresina, and other military objectives on the Carso plateau."

Rome, Nov. 13th.

"Our aeroplanes were simultaneously bombarding Volano, the seat of an Austrian command."

Rome, Nov. 14th.

"Our aviators on Friday under adverse atmospheric conditions made successful raids on the Carso plateau, bombing the stations at Refenberg, San Daniele, and Dottoliano, and long trains standing in them. An enemy Albatros and an Aviatik were met in the course of the raid, and put to flight by the fire of our machine-guns. Our aviators returned safely."

Rome, Nov. 15th.

"At half-past eight o'clock this morning two Austrian aeroplanes dropped bombs on Brescia, killing seven people and wounding ten. There was no material damage."

Montenegrin.

Paris (Legation) Nov. 12th.

"An Austrian aeroplane fell within our lines, and the airmen were made prisoners.

German.

Berlin, Nov. 10th.

"The Zeppelin airship which ascended at Temesvar with the Duke of Mecklenberg on board has landed in Sofia. King Ferdinand and his Court witnessed the landing."

Berlin, Nov. 11th.

"An English aeroplane was obliged to land north-west of Bapaume. The occupants were taken prisoners."

Berlin, Nov. 12th.

"In an aerial fight two English biplanes were shot down and a third obliged to land behind our front."

Austrian.

Vienna, Nov. 10th.

"At Nabresina several civilians, including one woman and two children, were killed by air bombs."

Vienna, Nov. 15th.

"One of our aerial squadrons recently bombarded Verona."

THE BRITISH AIR SERVICES.

UNDER this heading are published each week the official announcements of appointments and promotions affecting the Royal Naval Air Service and the Royal Flying Corps (Military Wing) and Central Flying School. These notices are not duplicated. By way of instance, when an appointment to the Royal Naval Air Service is announced by the Admiralty it is published forthwith, but subsequently, when it appears in the LONDON GAZETTE, *it is not repeated in this column.*

Royal Naval Air Service.

THE following appeared among the Admiralty announcements of the 10th inst.:—

The following have been entered as Probationary Flight Sub-Lieutenants, for temporary service, with seniority of Nov. 8th, and all appointed to "President," additional, for R.N.A.S.: O. M. Ayrton, T. C. W. Selby-Lowndes, J. Ree, J. Taylor, and H. T. Jones.

Temporary commissions have been granted as follows: F. V. W. Cook, as Lieutenant (R.N.V.R.); C. L. Hains, E. McD. Wright, L. H. Slatter, H. A. Beckenham, and N. W. Frames, as Sub-Lieutenants (R.N.V.R.), all with seniority of Nov. 8th, and appointed to "President," additional, for R.N.A.S.

The following appeared among the Admiralty announcements of the 12th inst.:—

Lieuts., R.N.V.R. (temporary), J. B. Soames and C. N. R. Wright promoted to the rank of Temporary Lieutenant-Commanders (R.N.V.R.), both with seniority of Nov. 10th.

Lieut., R.N.V.R. (temporary), G. G. McHardy entered as Probationary Flight Sub-Lieutenant, for temporary service, and appointed to "President," additional, for R.N.A.S. To date Nov. 11th.

Sub-Lieut. R. M. S. Veal promoted Lieutenant, with seniority Nov. 10th.

Sub-Lieuts. (temporary) T. B. Ross, N. R. Fuller, A. Douglas, R. Verey, A. N. Mansergh, F. M. Michell, W. C. W. Ingle, T. R. Johnson, and S. J. Hanna promoted Temporary Lieutenants, all with seniority of Nov. 10th.

F. J. McConnell, John I. Carlin, John A. B. Ball, John E. Barrs, and L. Whitworth entered as Probationary Flight Sub-Lieutenants, for temporary service, and appointed to "President," additional, for R.N.A.S. To date Nov. 15th.

The following appeared among the Admiralty announcements of the 13th inst.:—

Flight Sub-Lieut. H. F. Fowler promoted to the rank of Flight-Lieutenant, with seniority of Oct. 5th.

Temporary Flight Sub-Lieut. A. J. Whetnall transferred to Permanent List of R.N.A.S.

Temporary Sub-Lieut. (R.N.V.R.) J. G. Currie promoted to Temporary Lieutenant, with seniority of Sept. 1st.

G. B. Taylor entered as Probationary Flight Sub-Lieutenant, for temporary service, with seniority of Nov. 14th, and appointed to "President," additional, for R.N.A.S.

V. A. F. Bellamy granted a temporary commission as Lieutenant (R.N.V.R.), with seniority of Nov. 12th, and appointed to "President," additional, for R.N.A.S.

The following appeared among the Admiralty announcements of the 16th inst.:—

Flight Lieut. E. F. Bray, commission and appointment as Flight Lieutenant, terminated, Nov. 15th, and granted a temporary commission as Lieutenant (R.N.V.R.), with seniority of Nov. 15th, and appointed to "President," additional, for R.N.A.S., for (E.) duties.

H. Rampling, entered as Probationary Flight Sub-Lieutenant, for temporary service, with seniority of Nov. 17th, and appointed to "President," additional, for R.N.A.S.

The following have been granted temporary commissions as Sub-Lieutenants (R.N.V.R.), with seniority of Nov. 15th, and appointed to "President," additional, for R.N.A.S.: G. N. Gawler, G. R. Turner, and A. R. Griggs.

Royal Flying Corps (Military Wing).

THE following appeared in a supplement to the *London Gazette* issued on the 10th inst.:—

Flying Officers.—Oct. 26th, 1915: Temporary Lieut. G. H. Hall, Welsh Horse Yeomanry (T.F.); Second Lieut. C. H. Jenkins, Royal Sussex Regt., Special Reserve, and to be seconded; Second Lieut. T. Marburg, Special Reserve.

Memoranda.—To be Temporary Second Lieutenants for duty with the Royal Flying Corps: L.-Cpl. Henry B. Stubbs, 19th (Queen Alexandra's Own) Royal Hussars; Aug. 2nd, 1915. Pte. Reginald F. Wills, A.S.C.; Aug. 4th, 1915.

Supplementary to Regular Corps.—Second Lieutenants (on probation) confirmed in their rank: F. G. M. Williams and Theodore Marburg.

To be Second Lieutenants (on probation): Martin A. Shepstone; Oct. 1st, 1915. Ronald True; Oct. 10th, 1915. Wilfred J. Hewitt; Oct. 11th, 1915. Wilfred E. Marsden; Oct. 16th, 1915. Edward G. Landon; Oct. 17th, 1915. Oct. 18th, 1915: Rodney W. Heath and John R. B. Savage.

The following appeared in a supplement to the *London Gazette* issued on the 11th inst.:—

Flying Officers to be Flight-Commanders, and to be Temporary Captains whilst so employed.—Lieut. H. C. Tower, Special

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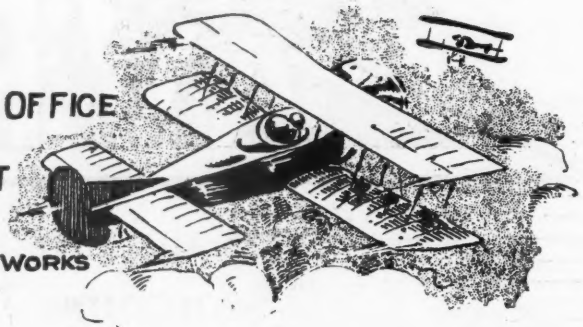

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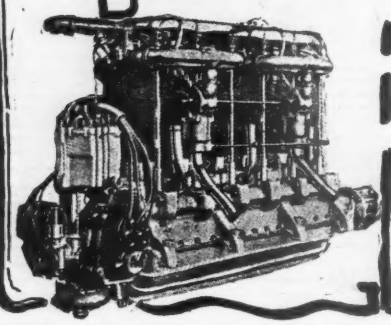

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Reserve; Oct. 19th, 1915. Temporary Second Lieut. E. D. Horsfall, General List; Oct. 28th, 1915.

Flying Officers.—Oct. 27th, 1915: Second Lieut. A. W. H. James, 3rd (King's Own) Hussars, and to be seconded; Second Lieut. S. T. Ravenscroft, Lancashire Hussars Yeomanry (T.F.); Second Lieut. F. D. Pemberton, R.A., and to be seconded. Oct. 28th, 1915: Second Lieut. F. Fernihough, R.F.A. (T.F.); Second Lieut. J. S. Castle, Special Reserve; Second Lieut. A. Charig, Special Reserve; Second Lieut. E. H. Pullinger, Special Reserve; Second Lieut. E. A. Cave, Special Reserve.

Supplementary to Regular Corps.—Second Lieutenants (on probation) confirmed in their rank: James S. Castle, Arnold Charig, Ernest H. Pullinger, Eric A. Cave, E. Taylor, W. Hart, K. P. MacNamara, B. W. Watts, C. Fergusson, F. Shumaker, E. Powell, A. Heywood, and Idwal O. Griffeth.

The following appeared in the *London Gazette* of the 12th inst.:—

Flight Commanders to be Squadron-Commanders.—Oct. 27th: Major F. W. Richey, R.A. And to be Temporary Majors whilst so employed: Lieut. (Temporary Capt.) C. W. Wilson, Seaforth Highlanders; Capt. A. E. Borton, D.S.O., Royal H.; Capt. R. M. Rodwell, W. Yorks; Capt. W. R. Freeman, Manchester.

Wing-Adjutant.—Temporary Capt. F. C. Shelmerdine, Yorks, and transferred to General List. Nov. 1st.

Flying Officers.—Oct. 21st, 1915: Temporary Capt. Right Hon. A. T. Lord Lucas, Hants Yeomanry; Temporary Second Lieut. G. Osmand, Oxford and Bucks L.I., and transferred to General List; Temporary Second Lieut. R. L. Johnston, R.A., and transferred to General List; Temporary Second Lieut. H. R. Hele-Shaw, R.A., and transferred to General List; Second Lieut. E. L. Crowe, E. Kent, S.R., and seconded; Temporary Second Lieut. C. H. R. Johnstone, Yorks, and transferred to General List; Temporary Second Lieut. E. D. Johnson, E. Surrey, and transferred to General List; Temporary Second Lieut. L. E. Eeman, R.F., and transferred to General List; Second Lieut. E. R. Vaisey, Essex, and seconded; Second Lieut. A. F. Brooke, 10th Hussars, and seconded; Second Lieut. G. P. S. Reid, Seaforth Highlanders, and seconded. Oct. 30th: Lieut. E. R. Pretyman, Somerset L.I., and seconded; Second Lieut. E. Cameron, Staff Yeomanry.

Supplementary to Regular Corps.—Second Lieutenants (on probation) confirmed in rank: F. W. Day and J. P. Rowell.

The following appeared in a supplement to the *London Gazette* issued on the 13th inst.:—

Supplementary to Regular Corps.—To be Second Lieutenants (on probation): William Boag; Oct. 27th, 1915. Harold Jameson; Oct. 30th. 1915. Ernest Bush; Oct. 31st, 1915.

The surname of Second Lieut. (on probation) Idwal O. Griffith is as now described, and not as stated in the *Gazette* of Nov. 11th, 1915.

The following appeared in a supplement to the *London Gazette* issued on the 15th inst.:—

Flight-Commanders to be Squadron-Commanders, and to be Temporary Majors whilst so employed.—Oct. 27th, 1915: Lieut. (Temporary Capt.) Eric L. Conran, 21st (Empress of India's) Lancers, and to retain his appointment at the Central Flying School; Lieut. (Temporary Capt.) George F. Pretyman, D.S.O., Prince Albert's (Somerset L.I.), and to retain his appointment at the Central Flying School.

Flight-Commander.—Capt. J. Valentine, Special Reserve, from an Equipment Officer, and to retain his temporary rank whilst so employed. Oct. 15th, 1915.

Flying Officers to be Flight-Commanders.—Nov. 5th, 1915: Capt. A. C. Beddam-Whetham, Princess Louise's (Argyll and Sutherland Highlanders), Special Reserve; Capt. P. C. Walby, Royal Welsh Fusiliers; Capt. L. Jenkins. Dorsetshire R.G.A. (T.F.); Lieut. R. R. Smith-Barry, Special Reserve, and to be Temporary Captain whilst so employed; Lieut. E. K. Davies, Special Reserve, and to be Temporary Captain whilst so employed.

Equipment Officer.—Capt. Lord R. E. Innes-Ker, Irish Guards, Special Reserve, from a Wing Adjutant. Oct. 15th, 1915.

Flying Officers.—Oct. 28th, 1915: Second Lieut. H. Kirby, Buffs (East Kent Regt.), and to be seconded; Second Lieut. T. M. B. Newton, Princess Charlotte of Wales's (Royal Berkshire Regt.), and to be seconded; Second Lieut. W. A. C. Morgan, Welsh Regt., and to be seconded.

Assistant Equipment Officers.—Aug. 13th, 1915: Qrmr. and Hon. Lieuts. J. E. Parkin, J. Mead, and W. J. Waddington, Royal Flying Corps. Aug. 23rd, 1915: Second Lieut. G. Somers-Clarke, Special Reserve; Second Lieut. N. Pellew, Special Reserve. Qrmr. and Hon. Lieut. W. Thomas, Royal Flying Corps; Aug. 29th, 1915. Second Lieut. E. A. Richards, Special Reserve; Aug. 31st, 1915. Second Lieut. I. O. Griffith, Special Reserve; Sept. 6th, 1915. Qrmr. and Hon. Lieut. G. Laing, Royal Flying Corps; Sept. 21st, 1915. Second Lieut. B. May, Special Reserve; Sept. 24th, 1915. Temporary Lieut. C. W. M. Ludgate, General List; Sept. 27th, 1915 Oct. 1st, 1915: Second Lieuts. P. P. Eckersley, P. K. Turner, and T. W. Webb, Special Reserve. Oct. 8th, 1915: Second Lieuts. H. R. Vagg, T. F. Bullen, and R. S. Rumbold, Prince Albert's (Somerset L.I.); Temporary Second Lieut. N. L. Robertson, General List. Second Lieut. Lord H. R. H. Gascoigne-Cecil, Special Reserve; Oct. 15th, 1915. Temporary Lieut. E. G. Toye, Duke of Cornwall's L.I., and to be transferred to the General List; Oct. 16th, 1915. Oct. 20th, 1915: Second Lieut. A. C. Gilling, Special Reserve; Temporary Captain A. G. Parsons, Royal Artillery, and to be transferred to the General List. Temporary Captain H. D. Dryden-Smith, Durham L.I., and to be transferred to the General List; Oct. 21st, 1915. Second Lieut. S. S. Nevill, Special Reserve; Oct. 22nd, 1915. Oct. 23rd, 1915: Capt. C. H. Rowe, Reserve of Officers; Second Lieut. W. J. King, Special Reserve; Second Lieut. W. J. Shields, Essex Regt., Special Reserve, and to be seconded; Second Lieuts. D. Easdale, G. D. Pidgeon, B. V. Grealy, F. S. Creswell, C. St. Noble, F. G. M. Williams, H. M. Fulton, and G. D. Hannay, Special Reserve. Second Lieut. R. Groves, Special Reserve; Oct. 25th, 1915. Oct. 26th, 1915: Second Lieuts. E. Taylor, W. Hart, K. P. MacNamara, E. Powell, F. Shumaker, C. Fergusson, B. W. Watts, and A. Heywood, Special Reserve. Temporary Second Lieut. T. C. Daniell, General List; Oct. 29th, 1915. Oct. 30th, 1915: Second Lieuts. F. W. Day and J. P. Powell, Special Reserve.

Memoranda.—Norman F. W. Rockey to be Temporary Second Lieutenant for employment with the Royal Flying Corps. Oct. 14th, 1915.

The following appeared in the *London Gazette* of the 16th inst.:—

Flying Officers.—Nov. 2nd, 1915: Temporary Lieut. A. H. Smith, Lincolnshire Regt., and to be transferred to the General List. Temporary Second Lieut. A. M. Miller, Reserve Regiments of Cavalry, and to be transferred to the General List. Second Lieut. J. A. Barraclough, King's Own (Royal Lancaster Regt.), and to be seconded. Second Lieut. W. C. Mortimer-Phelan, Special Reserve. Nov. 3rd, 1915: Temporary Second Lieut. K. N. Pearson, R.E., and to be transferred to the General List. Second Lieut. A. J. Copel, Prince Albert's (Somerset L.I.), and to be seconded. Temporary Second Lieut. E. R. Tempest, King's Own (Yorkshire L.I.), and to be transferred to the General List. Temporary Second Lieut. J. T. Rodwell, Essex Regt., and to be transferred to the General List. Second Lieut. J. L. Chalmers, Special Reserve. Second Lieut. R. W. Nichol, Special Reserve. Nov. 4th, 1915: Lieut. C. A. Brooks, Duke of Edinburgh's (Wiltshire Regt.), Special Reserve, and to be seconded. Second Lieut. T. Maxwell-Scott, Special Reserve. Second Lieut. C. S. Ross, Special Reserve.

Supplementary to Regular Corps.—Second Lieutenants (on probation) confirmed in their rank: Robert W. Nichol, Thomas Maxwell-Scott, Clifford S. Ross, William C. Mortimer-Phelan, James L. Chalmers.

To be Second Lieutenants (on probation): Kenneth D. G. Collier; Oct. 11th, 1915. Norman S. Percival; Oct. 14th, 1915. Thomas L. F. Burnett; Oct. 15th, 1915. Algernon L. Curtis; Oct. 18th, 1915. Charles G. Smith; Oct. 22nd, 1915. John Elgood, Nov. 4th, 1915.

❀ ❀

Safe Places and Air Raids.

REPLYING to Sir G. Scott Robinson in the House of Commons last week, Sir John Simon said that, generally speaking, people were safer indoors than in the streets during Zeppelin raids. In analysing statistics it must be remembered that after dark the majority of the population was normally under cover. In spite of this, in the attack on the London district between 9 p.m. and 10 p.m., on October 13th out of thirty-three persons killed and twenty-six seriously injured all but five were struck when in the open.

Three Birds from Ceylon.

THE fund started by the *Times of Ceylon* for the presentation of aeroplanes to the Imperial Aircraft Flotilla has enabled a third machine to be presented. It is a 100 h.p. Gnome-Vickers gun carrier, and will be known as a "Nightjar from Ceylon." The two others will be called a "Paddy from Ceylon" and a "Devil Bird from Ceylon."

❀ ❀

Two from Johannesburg and One from British Guiana.

THE women of Johannesburg have raised a fund for the provision of two 70 h.p. biplanes for the Imperial Aircraft Flotilla and the inhabitants of British Guiana have also subscribed for one 100 h.p. Gnome-Vickers gun carrier.

The Raid on the Krupp Works.

THAT the raid by Allied aviators on Essen last January was not quite so ineffective as the Wolff Agency endeavoured to make out is indicated by an entry in the annual accounts of Krupps which have recently been published in the German papers. This reads: "Claims and damages due to war, M.10,000,000" (£500,000).

CONSTRUCTIONAL DETAILS.—XI.

IN our previous series of undercarriages an attempt was made to classify these, as far as possible, in order to facilitate reference. The three headings under which they were arranged, it may be remembered, were double skid, single skid, no skid types. Having dealt with a number of examples of each type there still remain several very interesting and highly successful makes of undercarriage which are well worthy of notice, but which, owing to their characteristics, cannot be classified under any of the above headings. These form the subjects for our full page of illustrations this week.

Having stood the test of time and being, perhaps, one of the most ingenious undercarriages ever designed, the Blériot chassis will be dealt with first. The chief characteristic of this chassis is that it is fitted with castor wheels that are free to travel, not only upwards, but outwards to either side as well. The upward movement is obtained on the principle of the deformable triangle. Supported on two transverse members made of ash and secured to the fore part of the body are two vertical steel tubes of large diameter. Round the upper part of each of these tubes a collar is free to slide. Attached to this collar with their upper ends are two flattened steel tubes that form a fork round the running wheels which are secured to its lower end. Another fork that forms the third side of the deformable triangle to which reference is made above, runs from the lower end of the vertical tubes to the wheel. An inspection of the accompanying illustration should make the action clear. When the wheel moves upwards, its hub describing a portion of the arc of a circle, having for its centre the lower end of the vertical tube and having the lower, short fork as its radius, the movement is transmitted by the long forks to the sliding collar. The upward motion of this collar along the vertical tube is resisted by the rope-shaped shock absorbers seen in the sketch. These shock absorbers, of which there are two or four to each wheel according to their strength, have their ends fitted into metal caps from which strong steel wires are taken to the lower transverse member and to notched lugs on the sliding collars respectively.

The lower transverse member, or *planche* as it is sometimes called, is supported from the *fuselage* by six streamline wood struts, two of which are vertical whilst two slope forward to the nose of the body and two backward to the lower longitudinals. As the load is taken on the outer ends of the transverse members, these are strengthened by diagonal bracing, which, in the older machines, usually took the form of a steel band or tape, but which is now sometimes made of two stranded steel cables.

When landing with a slight sideways movement in relation to the ground the wheel, it will be seen, can move sideways by pivoting round the vertical tubes. This movement, however, is restricted by connecting the two wheel centres by a thin horizontal strut pivoted to the inner ends of the hubs and by diagonal cross wiring in which is incorporated elastic bands. The function of these bands, apart from restricting the lateral movement of the wheels, is to return the wheels to a central position. Although suffering somewhat from excessive head resistance, the Blériot undercarriage has much to recommend it on account of its extreme flexibility, which allows of making landings that are far from perfection without serious consequences to the machine.

Occasionally M. Blériot has attempted to break away from his standard type of undercarriage, rarely with success however. At the last Paris Aero Show there was exhibited a "pusher" biplane fitted with a somewhat unusual type of chassis, as shown in our second Blériot sketch, from which the action is fairly evident. The curved channel steel member that carries the wheel is universally pivoted round the lower end of the vertical chassis strut, while to its forward end is attached a shock absorber enclosed in a metal casing. No great amount of success, we believe, attended this design.

Another undercarriage that neither belonged to the skid nor to the "Vee" type was that of the last Deperdussin monoplanes. In this the framework of the chassis consists of two "U" shaped members built up of a number of laminations of wood, and attached with their upper ends to a longitudinal strip of wood running alongside and bolted to the sides of the body. The tubular axle rests on the lower curved portions of the "U," from which it is sprung by simply wrapping rubber cord around it and the bottom of the "U." The attachment of the lift cables is shown in one of the detail sketches, and is mainly interesting on account of the fact that these cables run right across from one wing to the other, being merely gripped by a steel plate where they pass under the ledge-shaped projection on the leading edge of the chassis struts.

Yet a different form of undercarriage was that of the Breguet biplanes, which was of the four-wheeled variety, as shown in one of the accompanying sketches. The main load is taken by two wheels mounted on a tubular axle, which is, in turn, supported on a pair of telescopic steel tubes with which are incorporated coil springs.

Another pair of wheels is mounted well out in front for the protection of the propeller and to prevent the machine from turning over on its nose in a rough landing. In order to facilitate steering on the ground at low speeds these front wheels are so mounted that their axle can oscillate in a vertical as well as in a horizontal plane. The detail sketch will help to make the exact method clear.

The Breguet chassis as well as the whole machine was, it may be recollected, made entirely of steel, the tubes, in the case of the undercarriage, being given an approximate streamline form by means of aluminium casings.

The last of our chassis sketches on this week's full-page illustrations shows the undercarriage of the curious H. Farman "one-and-a-half-plane" that was exhibited at the last Paris Aero Show (1913). The wheel track is very wide—4 metres, to be exact—and the two comparatively long stub axles, which have their inner ends pivoted to the front spar of the lower plane, are given an upward twist at their outer ends in order to bring the wheels into a vertical position. The two struts that support the wheel axle through rubber shock absorbers form a "Vee" as seen from the side, being secured at the top to the front and rear spars of the lower plane and converging to form the angle in which the axle rests. The wide track of this undercarriage, whilst rendering the machine practically immune from turning over sideways, or "cartwheeling" when on the ground, made the machine somewhat difficult to steer on rough ground owing to the long "leverage" of the wheels when encountering an obstacle.

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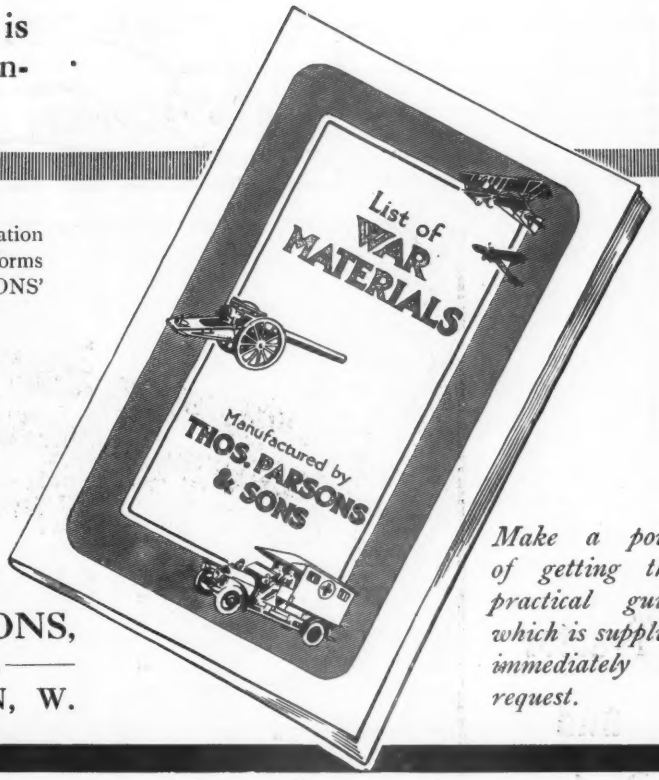

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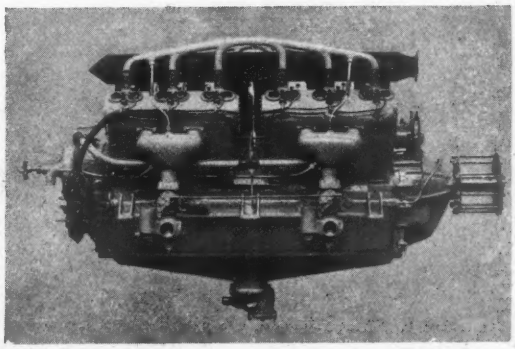

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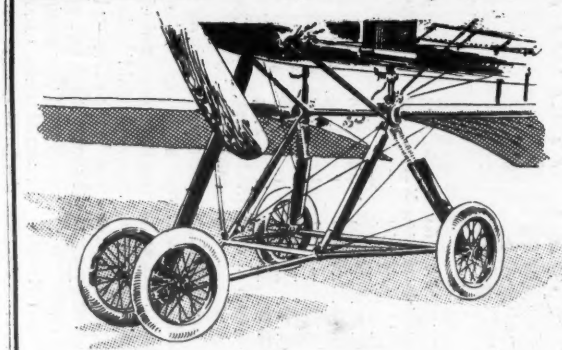
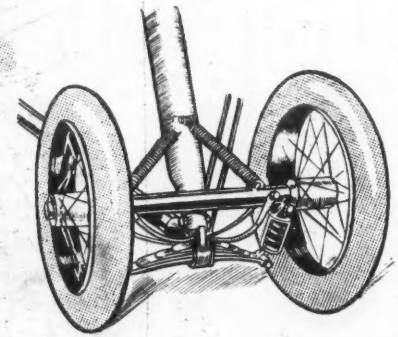
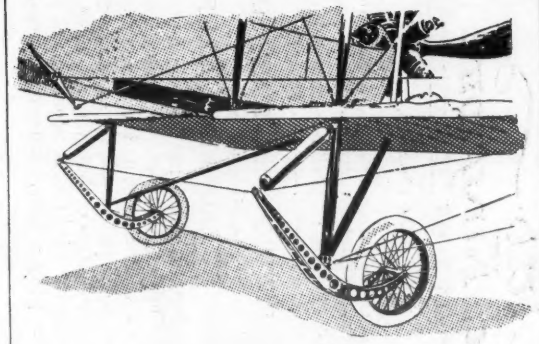
CONSTRUCTIONAL DETAILS.—XI.

Various French undercarriages. (*See text page* 892.)

BREGUET

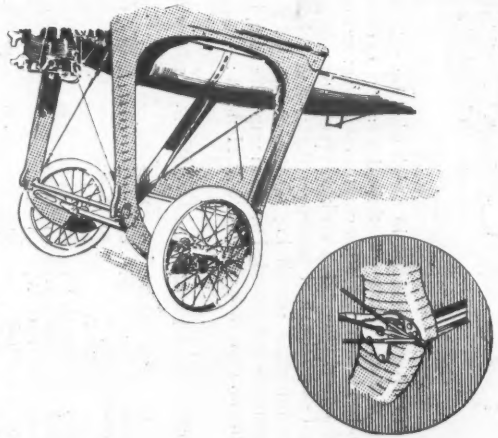




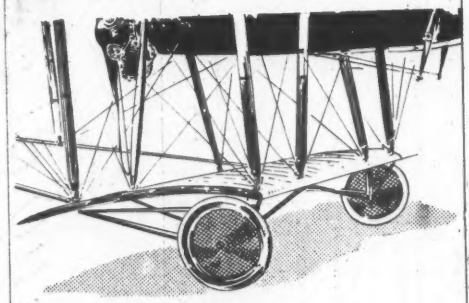


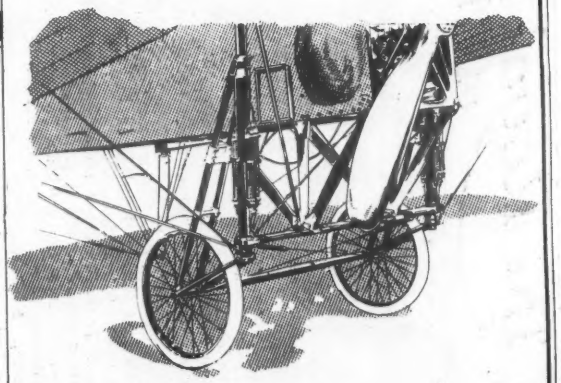
BLÉRIOT

DEPERDUSSIN



H. FARMAN





FLIGHT

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

Aviators' Certificates.

THE following Aviators' Certificates have been granted :—

2023 Flight Sub-Lieut. Cyril Askew Eyre, R.N.A.S. (Maurice Farman Biplane, Royal Naval Flying School, Eastchurch). Aug. 13th, 1915.

2024 Flight Sub-Lieut. Hugh Lawrence Francis, R.N.A.S. (Caudron Biplane, Royal Naval Flying School, Eastchurch). Oct. 2nd, 1915.

2025 Flight Sub-Lieut. Frederick Charles Clement Calder, R.N.A.S. (Caudron Biplane, Royal Naval Flying School, Eastchurch). Oct. 3rd, 1915.

2026 Flight Sub-Lieut. Irwin Napier Colin Clarke, R.N.A.S. (Caudron Biplane, Royal Naval Flying School, Eastchurch). Oct. 3rd, 1915.

2027 Flight Sub-Lieut. Robert John Orton Compston, R.N.A.S. (Caudron Biplane, Royal Naval Flying School, Eastchurch). Oct. 22nd, 1915.

2028 Harold Thomas Mellings (Caudron Biplane, Beatty School, Hendon). Nov. 11th, 1915.

2029 Flight Sub-Lieut. Ernest William Clarence Corry, R.N.A.S. (Maurice Farman Biplane, Central Flying School, Upavon). Nov. 11th, 1915.

2030 Eric Leslie Pearson (Maurice Farman Biplane, Military School, Brooklands). Nov. 11th, 1915.

2031 John Winckworth Bailey (Caudron Biplane, Ruffey-Baumann School, Hendon). Nov. 14th, 1915.

Aeronaut's Certificates.

The following Aeronauts' certificates have been granted :—

49 2nd Lieut. Wilfrid Henry Furlonger, R.F.C. Nov. 15th, 1915.

50 2nd Lieut. Thomas Farquhar Lucas (3rd Royal Warwickshire Regiment). Nov. 15th, 1915.

51 Lieut. Henry Whitaker, R.F.C. Nov. 15th, 1915.

Extension of the Hours of Opening the Club.

The Club is now open from 9 a.m. to 10.30 p.m. each day, including Sunday.

New Members.

Members are reminded that, according to the Rules, the Annual Subscription of any New Member they may propose, who is elected between November 1st and December 31st of this year, will cover the period up to December 31st, 1916.

THE FLYING SERVICES FUND
administered by
THE ROYAL AERO CLUB.

THE Flying Services Fund has been instituted by the Royal Aero Club for the benefit of officers and men of the Royal Naval Air Service and the Royal Flying Corps who are incapacitated on active service, and for the widows and dependants of those who are killed.

The Fund is intended for the benefit of all ranks, but especially for petty officers, non-commissioned officers and men.

Forms of application for assistance can be obtained from the Royal Aero Club, 166, Piccadilly, London, W.

Subscriptions.

	£	s.	d.
Total subscriptions received to Nov. 10th, 1915	10,008	9	11
Employés of A. V. Roe & Co., Ltd., for four weeks ending October 29th, 1915	37	19	8
Collected at the Westland Aircraft Works, Yeovil (Ninth contribution)	0	9	9
Total, November 17th, 1915 ...	10,046	19	4

B. STEVENSON, Assistant Secretary.

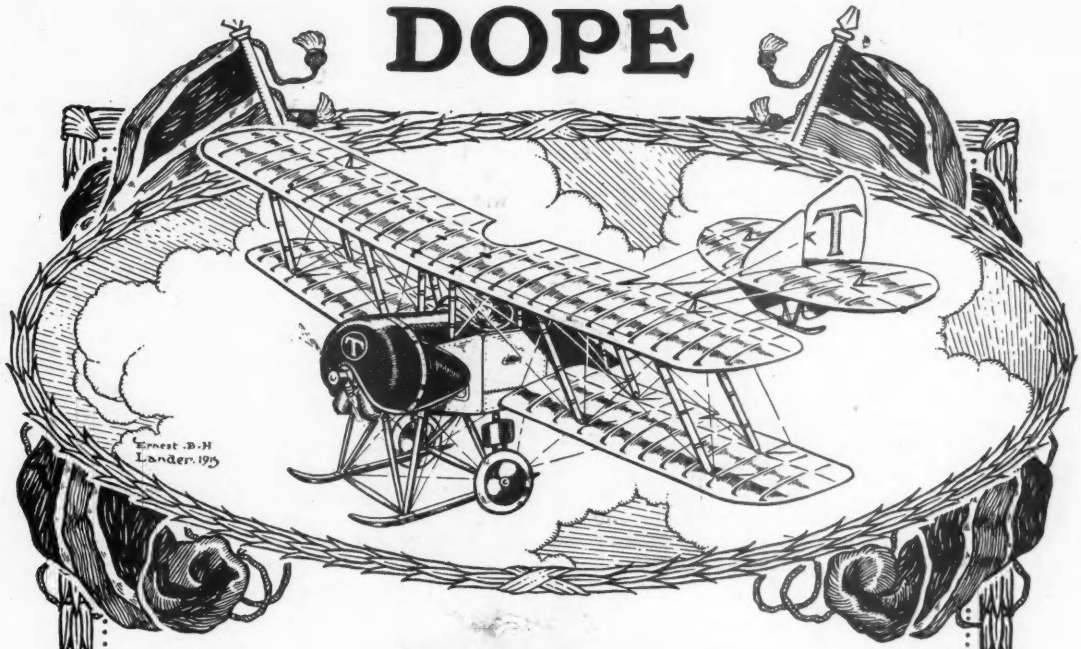
166, Piccadilly, W.

EXCEPT for a fine flight in a high wind by a BE 2c, there was nothing doing on Saturday afternoon last. On Sunday, however, weather conditions were more favourable and a good afternoon's work was put in, consisting of the usual exhibition and passenger flights and school work. The following official log of the afternoon's flying, as announced and recorded by the megaphone man, is typical of the airwork now to be seen at Hendon :—

Pilot.	Biplane.	h.p.	Passenger.	Time. Ascent.	Time. Descent.	Announced in
Russell ...	305 G.-W.	60	None	3. 5	3.15	Exhibition
Manton ...	303 G.-W.	60	1	3.10	3.30	Passenger
Kenworthy	B.-W. ...	50	None	3.10	3.18	Exhibition
,,	B.-W. ...	50	1	3.21	3.30	Passenger
Pashley ...	301 G.-W.	60	1	3.34	3.37	School
Russell ...	305 G.-W.	60	None	3.35	3.45	Exhibition
Winter ...	110 G.-W.	50	—	3.35	3.45	,,
Pupil ...	Hall ...	50	—	3.35	3.40	School
Pupil ...	Ruffy-B.	50	—	3.35	3.42	,,
Manton ...	G.-W. ...	60	—	3.38	3.47	Exhibition
Pupil ...	Hall ...	50	—	3.45	3.50	School
Winter ...	301 G.-W.	60	1	3.45	3.53	Passenger
Pupil ...	Ruffy-B.	50	None	3.47	3.53	School
Pupil ...	Hall ...	50	—	3.47	3.55	,,
Pupil ...	L. & P. ...	45	—	3.50	3.55	,,
Pashley ...	G.-W. ...	60	Pupil	3.50	3.57	,,
Russell ...	G.-W. ...	60	1	4. 5	4.13	,,
Manton ...	G.-W. ...	60	1	4.20	4.30	,,
Kenworthy	B.-W. ...	50	1	4.25	4.33	,,
Winter ...	G.-W. ...	50	1	4.30	4.39	,,
Russell ...	G.-W. ...	60	1	4.35	—	,,
Hawker ...	Sopwith ...	Arrived		2.25	(two exhibitions)	
		Departed		4.15		

It will be noticed that according to the official log Friend Russell, who ascended at 4.35, has not yet returned. An intelligent person once enquired of one of our famed pilots what would happen should he be unable to stop his engine when away high in the skies—"I should just have to go on flying until I starved to death, madam," was his ready reply. We sincerely trust that a similar fate has not overtaken Russell. *In case* of such a catastrophe, and taking into consideration the lapse of time, we suggest that a fast scout be despatched with provisions.

TITANINE
DOPE



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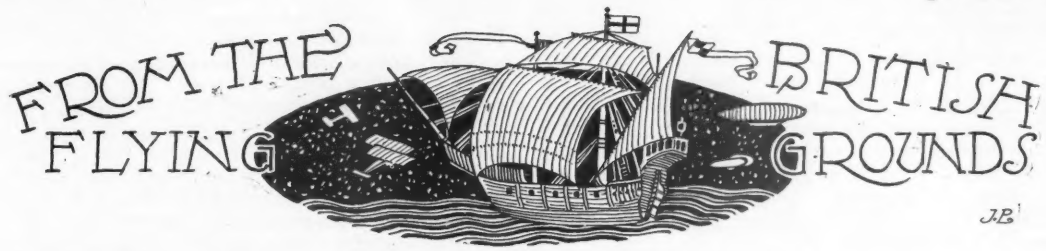

London Aerodrome, Collindale Avenue, Hendon.

Grahame-White Civilian School.—Pupils doing straights with Instructor last week: Messrs. Franck, Gammon, Halet, Holman, McConnel, and Henshaw. Straights alone: Mr. Horridge. Circuits with Instructor: Messrs. Fraser and Hughes. **Grahame-White School (R.N.A.S.)**—Pupils doing straights with Instructor: Probationary Flight Sub-Lieuts. Armitage, Horniman, Malet, Ovens, and Saint. Circuits and eights with Instructor: Probationary Flight Sub-Lieuts. Aplin, Davenport, and Moody. Circuits and eights alone: Probationary Flight Sub-Lieuts. Graham and Cross.

Instructors during week: Messrs. Manton, Pashley, Russell, and Winter.

Certificates during week: Probationary Flight Sub-Lieuts. Gammon and Sadler.

Beatty School.—The following pupils were out during last week: Begg, Bowick, Brown, Byrne, Brynildsen, Barnes, Collier, Cumming, Davison, Edwards, Fawcett, Fellowes, Fry, Godfrey, Hodgson, Jones, Mellings, Podmore, Richard, Samter, Scott, Smith, Summers, Whincup, Willmett, and Williams.

The Instructors were Messrs. G. W. Beatty, W. Roche-Kelly, R. W. Kenworthy, G. Virgilio, A. E. Mitchell, and L. L. King, the machines in use being Beatty-Wright dual-control and single-seater propeller biplanes, and Caudron tractor biplanes.

Four more pupils flew for their certificates this week—Messrs. Brown, Campbell, Fawcett, and Mellings.

Exhibition flights were given on Sunday by R. W. Kenworthy.

Hall School.—The following pupils were out receiving flying practice last week:—With H. F. Stevens: Broad. Flying solo circuits, figure eights with practice landings:—With Cecil M. Hill: Messrs. Nicolle, Butterworth, Drew, Stirling, Dodd, Dresser, Shum, Rattray, Manley, Cook, Evans, Wilkins and Lieut. Bell. With Charles Bell: Messrs. Redford, Capt. Grey, Mann, Smith, Arnsby, Bond, Millburn, Cosgrave, Chapman, Thom, Bennett, Niel, Baron Ackroyd, Le Coq Moir and Cumberbirch.

Aeroplanes in use: Hall tractor (Government type) biplanes.

The Royal Aero Club certificate was taken by Broad, who qualified in a highly satisfactory manner.

The following pupils should shortly be qualifying: Messrs. Drew, Cook, Manley, Butterworth, Stirling and Wilkins.

London and Provincial Aviation Co.—Pupils doing rolling last week: Messrs. Dawson, Roberts, Lees, Scott, Lambert, Jones, Hunt, and Martin. Doing straights: Messrs. Renton, Knowles, Lewis, Jowett, Woods, Thorpe, Hardy, Braim, Atkinson, Burgess, Heyn, and Summerskill. Circuits and eights: Messrs. Porter, Franklin, and W. Warren, jun.

Instructors: Messrs. M. G. Smiles, W. T. Warren, and C. M. Jacques.

Ruffy-Baumann School.—Very bad weather prevailed again during last week but in spite of the circumstances

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A sextet of pupils who have secured their tickets at the Ruffy-Baumann Flying School at Hendon.—1. 2nd Lieut. R. Clive Gallop (2nd Scottish Rifles); 2. Mr. W. Hughes; 3. Sub-Lieut. W. E. Gardner; 4. 2nd Lieut. P. B. Prothero (4th Argyll and Sutherland Highlanders); 5. 2nd Lieut. W. R. B. McBain (R.F.A.); 6. 2nd Lieut. Albert Ball (N.M.D.C.C., now R.F.C.).

most of the pupils have been enabled to have instruction, and three certificates have been taken. Messrs. W. Hughes, W. G. Stewart, and Bailey successfully secured their tickets, all in good style.

The following students have been out on the 60 and 50 h.p. Gnome-Caudron type and Ruffy-Baumann machines: Lieut. Yiule, Messrs. Cole, Harkness, Vernon, de Grauw, Coppens, Wood, Cuthbertson, Bolton, Liddell, Griffiths, Launoit, Tomson, Laidlaw, Fraser, Cox, Pauli, Hamtiaux, and Sherwood.

Instructors: Edouard Baumann, Felix Ruffy, Ami Baumann, and Clarence Winchester.

Northern Aircraft Co., Ltd.

The Seaplane School, Windermere.—A violent north-easter was raging most of last week. Mr. Rowland Ding was out in the 100 Anzeni monoplane in winds between 35 and 40 miles per hour. It was a fine test of both pilot and machine. Mr. Lankester Parker, too, has taken the 80 Gnome biplane out in winds hitherto thought to be inadvisable. On Sunday he climbed her with full tanks and passenger to 1,000 in 5 min. 30 sec.

With Instructor: Coats (24 mins.), Harvey (31), P. H. Ingham (17), Jeffries (8), Salton (12), Stubbs (10), Shaw (8) and Macrow (7).

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CORRESPONDENCE.

A Criticised Criticism Re-criticised.

[1913] Under the heading of "Eddies" in your issue of November 5th, you publish a paragraph which compels my reply, a reply permeated with great regret at the attitude taken up by your contributor.

I can only imagine that your correspondent, barren of topics aeronautical upon which to write, wilfully misconstructed this letter of mine to the press on the possibilities of the aeroplane as a weapon of offence and defence against the Zeppelin. My contention, if I may be permitted the courtesy of your columns, in simple language was this:—that the aeroplane can be made the effective reply to the rigid dirigible balloon, and in this contention I think I can modestly contend that I have the support of every sincere worker for the development of aeronautics.

I am tremulous with dismay at the wrath which my letter has aroused in the bosom of your contributor. I had no idea that a commo sense letter on a subject which I have studied since the days when I spent a most interesting *vacance* with Wilbur and Orville Wright in France, when Europe for the first time in history saw a human fly in the air, would have aroused the titanic irony of your writer. Rather had I hoped that I should have met with encouragement from those who are desirous of fostering and developing the science of flight. That I find it otherwise in the pages of "FLIGHT" I ascribe entirely to an oversight of yourself—Sir.

And now let me again repeat for the education of your caustic scribe my contention—it was this:—that it is not impossible for the skilled aeronautical engineers of this country to design a machine which shall patrol the air from dusk to dawn, and which shall be able to carry, beside the load of fuel and lubrication and crew, machine guns, searchlights and wireless installation.

Your contributor in his eagerness to display his own mastery of the technique of aeronautics ridicules the idea of there being an internal combustion motor which shall function for 12 hours—but I said nothing of a single motor. And further he brightly flashes his wit at the expense of my ignorance when I suggest that Mr. Lloyd George could supply the necessary engines. I am sorry that I did not amplify my statement by saying that an ordinary civilian desirous of building aeroplanes must get a permit for the release of engines from the Minister of Munitions (Mr. Lloyd George). And I *know* that the engines I require can be built in two months.

In conclusion, Mr. Editor, may I meekly point out that I did not claim to be the designer of the aeroplane that shall fly from dusk to dawn—I merely said that, given the engines, I would build (not design) the *fuselages* in two months. I have much pleasure in telling you that I have associated with me the gentleman who has built *all* the giant aeroplanes yet constructed, and his designs are so far the very last word in big machines. Had your correspondent real knowledge on the subject—so serious to us all—on which he so cheaply jests he would have swallowed his pen rather than have written those foolish words. Does he really think that the aeroplane cannot be developed beyond an open *nacelle* machine with an engine of say 90 or 125 or even 300 horse power? If this be his attitude he should surely not figure as an authority on flight.

HAMILTON EDWARDS.

20, Copthall Avenue, E.C.

[The quotation on November 5th by "Æolus," of the text of Mr. Edwards' letter speaks for itself, and gives to "think furiously" whether there was any wilful misconstruction on his part. We note that Mr. Edwards claims now to put the idea expressed in his criticised letter into simple language, which process might, we think, have been followed with advantage in the above further communication. We are sorry we cannot trace the smallest sign of the suggested "wrath," in the paragraph in "Eddies," in fact the boot appears to be on the other leg, and we are a little in doubt as to whether our correspondent's reference to "titanic irony" is to be accepted as a compliment or the reverse. At least "FLIGHT" can claim without much misgiving a desire to encourage the science and art which it represents, but it does not necessarily follow that the claims which are put forward by Mr. Edwards, however good his intentions may be, tend in the same direction. As Mr. Edwards apparently would be so minutely particular in his expert phraseology, it might be as well to point out that he claimed in his original letter he would build 50 *machines* in two months—not as he now suggests *fuselages*—a mere bagatelle in difference. As to what "Æolus" thinks in regard to the development of aeroplanes, this is a fairly big subject, and his views in this respect might, we think, astonish even Mr. Edwards in their optimism, so we can hardly accept as correct our correspondent's guesses as to our contributor's possible opinions.

We appreciate one piece of generous abstention from criticism, viz., the slip of "Æolus" in transposing "sunrise" with "sunset" in his few opening lines.—ED.]

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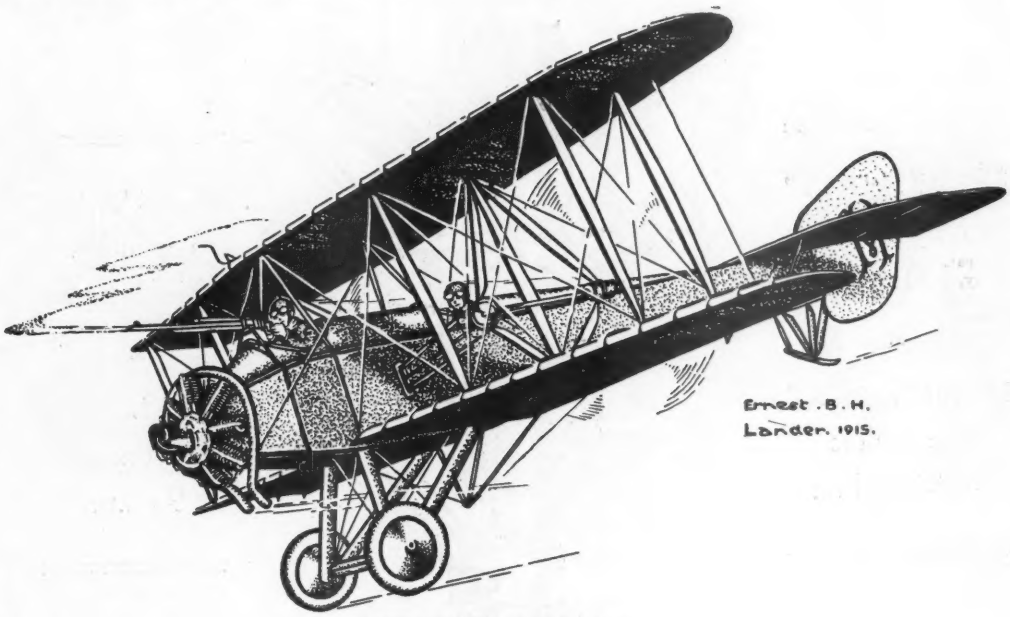
The Late Mr. Gustav Hamel.

FOR many months, in fact almost from the outbreak of war, the wildest rumours have been bandied about in regard to the fate of Gustav Hamel. We have never placed the smallest reliance upon them, and have never made reference to any of these offensive statements, so that we welcome the following plain denial of these rumours and reminder of the facts sent to the Press, under date November 16th, by Messrs. Oliver Richards and Parker, of 1C, King Street, St. James's, as solicitors on behalf of the family of the late very popular pilot:—

"The persistent rumours that the late Mr. Gustav Hamel is alive and flying for the Germans is giving great pain to his family and to his many friends. Unfortunately the first part of the rumour is untrue; the second is an insult to the memory of one who has done so much for the advancement of aviation in England. Mr. Hamel left Hardelot on May 23rd, 1914, to fly to England and was never seen alive again. His body was found in the sea by the skipper of the French fishing smack "St. Hélène," one Joseph Le Pretre, on July 1st, 1914, about 10 miles off Point Alprecht. It was identified by the description of the clothing and certain contents of the pocket described by a French mechanic, Alexis Longuet, who assisted him when he left Hardelot, and by the inflated indiarubber bicycle tube round the body which Mr. Morane, the eminent aeroplane designer, induced him to wear when he left Paris the same morning. There can be no shadow of doubt as to the identification of the body. On the evidence of Le Pretre and Longuet the Court has granted leave to presume his death and letters of administration to his estate have been taken out. Mr. Hamel came of a Danish family. He was brought up in England and was educated at Westminister School. His father, Dr. Gustav Hamel, M.V.O., who came to England many years ago, is a British subject. He was born in Hamburg, then a free and independent town. Early in life he went to Sweden and later continued his education in Switzerland, where he took his medical degrees. He requalified in England (St. Bartholomew's Hospital) and holds no German degrees or qualifications whatever. Nothing could be more repugnant to the family of the late Mr. Gustav Hamel than the reports that he is now enrolled in the German Flying Corps. May we ask you, as solicitors to the family, to publish this letter and put an end once and for all to baseless rumours?"

To Munition Firms desirous of opening an Aviation Branch and Others.

THE Owner of a new and highly successful type of Battleplane is desirous of selling the complete rights of same, including one finished machine and a small Works completely equipped with tools and machinery. His reason for selling is simply that he is unable for professional reasons to spare the necessary time required for extending this business to execute forthcoming orders. The services of the Manager, Designer, and Staff may be retained by mutual agreement.



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(1) This machine has been flown approximately a thousand miles at a well-known aerodrome.
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(4) The machine is automatically stable and has been safely flown in the strongest winds.
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ENQUIRIES AND OFFERS only entertained from Principals or their Solicitors. Full and complete investigation invited. The Battleplane can be seen flying by appointment at any time. Write in first instance to Box 3651, c/o "FLIGHT," 44, St. Martin's Lane, W.C.

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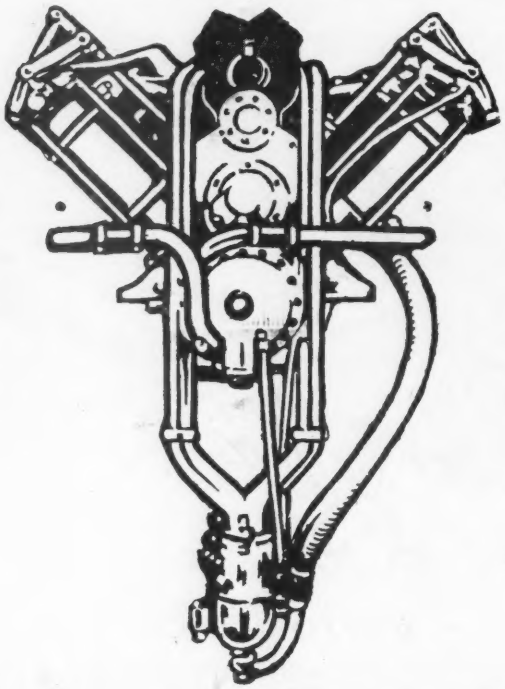

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GENERAL AVIATION ACCESSORIES.

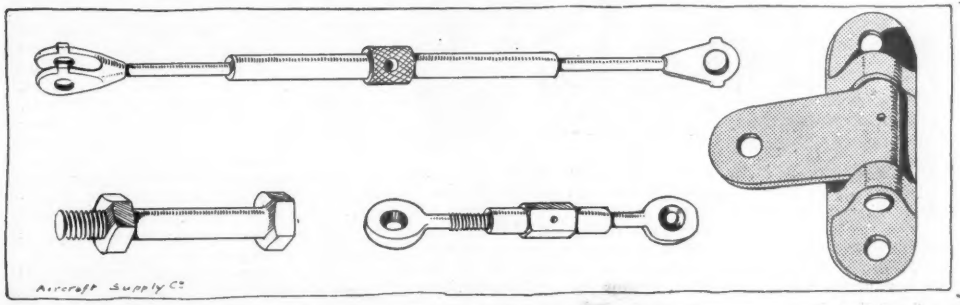
The Acetylene Corporation of Great Britain, Ltd., 49, VICTORIA STREET, WESTMINSTER.

A SPECIALITY of this firm is a new portable carbide-to-water acetylene generator made of mild steel sheets welded together by the oxy-acetylene process and the whole galvanised after construction. It takes a charge of 12 lbs. of carbide and is 16½ ins. in diameter by 3 ft. 4 in. overall. Weight empty about 1 cwt. It is claimed that owing to the special design of this generator there is no wastage of gas through after generation when the blow pipes are shut down, aed it will deal with any metal up to 1 in. thick. The water used for sealing the bell is separate from the water used for decomposing the carbide; consequently, recharging is very simply and quickly accomplished. The manhole cover is unscrewed and the carbide cage removed, the cludge valve is then opened and the centre chamber washed out. The cage is then filled with a fresh charge of carbide and the manhole cover replaced. The gas is thoroughly washed and passed through the purifier before leaving the plant.

Acetylene Illuminating Co., 268-270, SOUTH LAMBETH ROAD, S.W.

IN installing an oxy-acetylene welding plant, there are two systems, known respectively as high and low pressure, and the former has several advantages in its favour, two of the most prominent being its portability and the purity of the gas, which is compressed acetylene stored in steel cylinders containing a porous material, The absolute purity of the acetylene when prepared in this way is assured since it is impossible to "dissolve" the gas unless it is first thoroughly freed from all deleterious substances such as sulphur, phosphorus and ammonia.

Dissolved acetylene (D.A.), as it is called when so prepared, is, as is well known, the product of the Acetylene Illuminating Co., a firm who were the actual pioneers of the oxy-acetylene process of welding. Although advocating the high pressure system for all important work, the company also manufacture low pressure plants, in which the acetylene is delivered to the blowpipe at a pressure approximately atmospheric from a generator similar in principle to those used for headlights on cars.



Some specialities of the Aircraft Supplies Co.

The Aircraft Supplies Co., 17, JOHN STREET, THEOBALDS ROAD, LONDON, W.C.

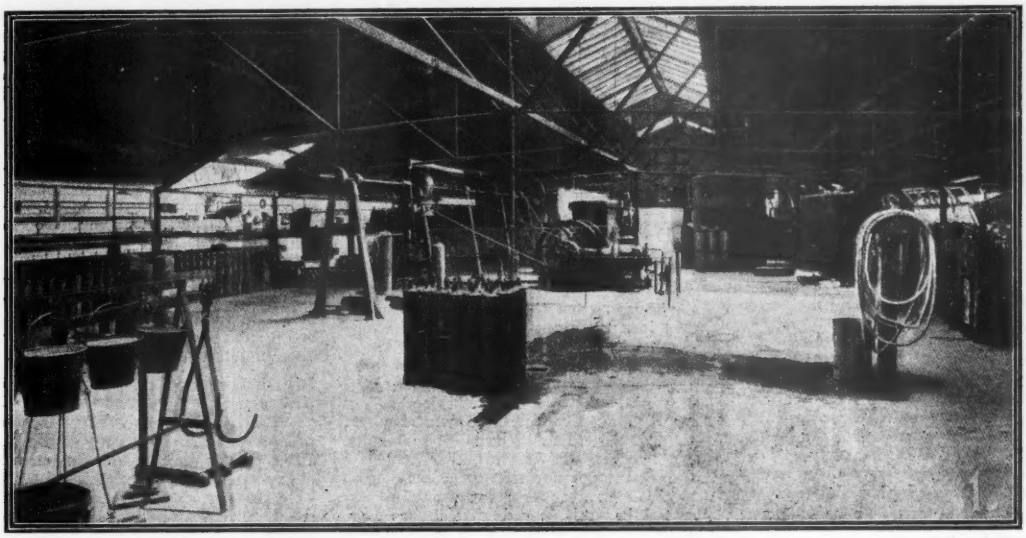
CONCEIVED on unique lines, the policy of this business is to meet the demand for those fittings which the ordinary busy manufacturer in these days finds difficulty in obtaining, a few of these lines being wing-flap hinges (20-21-22 A. 4029), Binet type, 4 and 5 mm.; strainers, short; bright hex. bolt; and nuts, 5 by 45 mm. (a very useful size) s hex. nuts, A.G.S. 115C, 114B and 118A; and the familiar R. A. F. turnbuckles (A.G.S. 141). From time to time, as the business grows, doubtless other "lines" will be specialised in. A useful institution is the weekly issue of the *A.S.C. Bulletin*, which sets forth the special lines in stock, and those which are available for early or advanced deliveries. A copy can be obtained regularly by anyone interested in the manufacturing side of aviation.

Anglo-American Oil Co., 36, QUEEN ANNE'S GATE, WESTMINSTER, S.W.

ONE of the most familiar sights at any aerodrome are the green cans in which Pratt's "Perfection" spirit is packed, and it affords the most convincing proof of the popularity of this motor spirit. Its reliability, purity and economy are too well known to need more detailed reference here.

The Allied Aircraft Varnish Co., Ltd., 38, FARRINGDON STREET, LONDON, E.C.

FORMED out of two existing firms both having long experience in fabric and linen varnishes, the Allied Aircraft Varnish Co., Ltd., at the outbreak of war set to work to meet the tremendous demand for dopes, varnishes and paints for all forms of aircraft



Interior of the D.A. compressing works, of the Acetylene Illuminating Co., where the cylinders are charged.

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work, the entire production being English manufacture.

The demand for their specialities is large and increasing, and the well-equipped works are turning out supplies of all the above not only for English but foreign Governments, and the firm are fortunate in having command of supplies of raw materials of practically unlimited output.

Their specialities are as follows :—

Dope to R.A.F. specifications; special "A" dope; fabric varnishes (2 sorts); woodwork, copal, propeller, boat, and shellac varnishes; paints and enamels to resist dope.

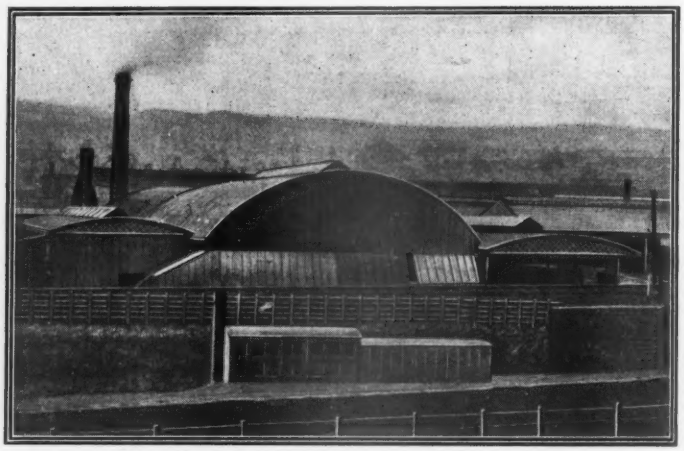
They also carry large stocks of Acetone.

D. Anderson and Sons, LAGAN FELT WORKS, BELFAST.

ALTHOUGH in a rapidly expanding industry like aviation, where it is often necessary to make additions in a minimum of time, it is essential that the roofing should be absolutely weather proof. It is in this connection that Messrs. D. Anderson and Sons specialise with their Rok roofing, which is the result of their long experience in the felt trade. To show the length of that experience, it is sufficient to say that the firm was supplying Roofing felt to the British War Office during the Crimean war. Determined to thoroughly test the weather resisting qualities of Rok roofing before it was placed on the market, lengthy trials were carried out in India and other tropical countries, and the firm guarantee it to be the most permanent roofing on the market.

Only the highest grade of wool felt is used in its manufacture. This is saturated with an elastic waterproofing compound, which does not dry out or evaporate in any climate, as it contains no oils, or volatile matter. The coating on the surface is a permanent one, composed of a natural bitumen of very high melting point. There is nothing of an organic nature in either the saturating or coating compound.

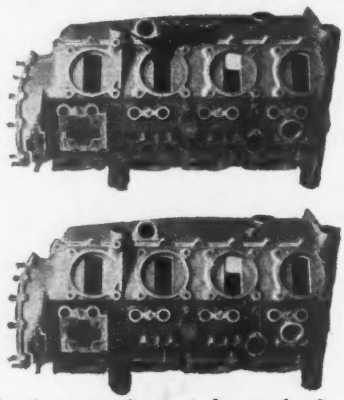
Rok is acid and alkali proof. White ants won't attack it. Rain water from roofs covered with it can be used for domestic purposes. Being an excellent non-conductor, it ensures an even temperature, and is therefore an ideal roofing for hot climates.



An example of the application of Rok roofing by Messrs. D. Anderson and Sons.

Barimar, Ltd., 10, POLAND STREET, LONDON, W.

AN interesting example of the efficiency of Barimar welding is afforded by this aluminium crank-case from an 8-cylinder aeroplane engine. The top and bottom halves and the cylinder base were badly smashed, and the torn cavity shown called for most expert handling, for none of the smashed pieces were available. Barimar effected a perfect repair, lined and machined, and the perfect finish and clean up should be noted in the second illustration. There is absolutely no trace of repair. Among welding firms Barimar, Ltd., have set an extremely high standard in repair work in all metals and alloys, and the great economy of Barimar welding is quickly apparent.



An 8-cyl. crankcase before and after repair by Messrs. Barimar, Ltd.

The Blackburn Aeroplane and Motor Co., Ltd., OLYMPIA, LEEDS.

APART from the building of complete machines, the Blackburn Co. some time ago decided to specialise in the production of various metal parts, and they are now in an advantageous position to supply sheet-steel pressings, steel stampings, machined fittings for B.E. 2c aeroplanes; also turnbuckles, R.A.F. and Admiralty type, special bolts, eyebolts, wheels, &c. Another branch of the business is devoted to the building of propellers in all types and sizes, and so successful has this proved that it has been necessary to make a large extension to the works to meet the demands for more rapid production. In view of the extensive equipment, the firm are also in a good position for the manufacture of tanks, cowls, &c., to any specified design.

The British Aeroplane Varnish Co., Ltd., 166, PICCADILLY, LONDON, W.

"TITANINE" is the speciality of this firm, and, as the style of the firm implies, this dope is British made. Several special features are claimed for "Titanine," the most important of which are :—flexibility, imperviousness, flame-proof, adhesion, and freedom from Tetrachlorethane.

Flexibility is, of course, a most important feature, and a piece of fabric doped with "Titanine" can be bent or folded again and again without showing any signs of cracking or peeling. At the same time the dope fills in the pores of the fabric thoroughly, and thus prevents varnish, &c., from penetrating to, and rotting, the fabric. The dope itself is absolutely fireproof, and a lighted wax match laid on a plane doped with "Titanine" will just burn completely away without setting fire to the plane. "Titanine" is entirely free from Tetrachlorethane and all poisonous and heavy spirits and is therefore harmless to workers. It dries with a dull surface, and affords a good hold for varnish or paint. Four coats applied in the usual way leave a deposit of about 2 oz. per square yard. The manufacturers state that it has been proved from experience that no dopes resist climatic conditions unless protected by suitable varnish or paints; they have therefore placed on the market a varnish and paints suitable for the purpose.

We also understand this firm are able to fill their customers' requirements with the utmost despatch, an important item in these strenuous times.

The British Emaillite Co., 30, REGENT STREET, S.W.

As announced last week, the new works of this company are now working at full capacity to meet the ever-increasing demands for Emaillite. Throughout the new installation every advantage has been taken of the most modern methods and machinery to ensure that the high reputation for quality and purity which has been won by Emaillite shall be still further enhanced and the works have also been specially organised to supply dopes to all Government specifications. In passing, it may be noted that in all grades of Emaillite the proportion of Tetrachlorethane has been reduced to the lowest possible limit. For identification marks, an Emaillite tightening dope in any colour is supplied. This grade is oil and waterproof, and does not run.

Emaillite finishing varnish, which preserves the doping and increases the durability very considerably, is also being produced at the new works, and extensively adopted by the Government and various constructors.

To facilitate delivery of Emaillite dope and varnish and collection of empty carboys and drums, good use is made of the G.A.C.'s newly converted Chenard-Walcker "lorry," and the firm's clients can invariably rely upon promptitude in despatch.

British Oxygen Co., ELVERTON STREET, WESTMINSTER, S.W.

WITH their extensive experience in connection with blowpipe work dating back to a considerable time before the introduction of oxy-acetylene system, the British Oxygen have a considerable advantage. They supply oxy-acetylene (low or high pressure) apparatus for welding and metal cutting, and in our illustration will be found two of their specialities—the "Universal" blow-

Telephone :—4167 Gerrard.

MASCHINENFABRIK (Ateliers de Construction)

OERLIKON

Telegrams :— Oerlik, Estrand, London. SWITZERLAND.

MANUFACTURERS OF — ELECTROLYSERS FOR PRODUCTION OF HYDROGEN & OXYGEN.

SPECIALITIES.

Steam Turbines.

—

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FOR DIRECT CURRENT, SINGLE PHASE & THREE PHASE ALTERNATING CURRENT.

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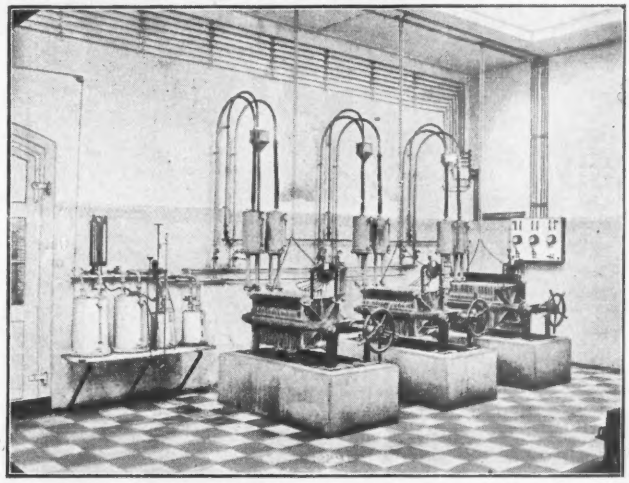
FOR ALL INDUSTRIAL PURPOSES.



OERLIKON ELECTROLYSER FOR PRODUCTION OF 2,830 CUBIC FEET OF HYDROGEN IN 24 HOURS.

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Electric Cranes.

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Electric Drills.

OERLIKON WORKS UNDER WAR CONDITIONS :— The Maschinenfabrik (Ateliers de Construction) Oerlikon is a PURELY SWISS undertaking, financed, run and managed by Swiss, and all labour is Swiss up to quite 98%, the remaining 2% being constituted by men from almost all countries in the world. Import facilities mainly from Great Britain, America, &c., and Export facilities via Genoa, Dieppe, Bordeaux, Treport-Cette, &c., and the stocks of raw materials at the Stores enable good deliveries to be given.

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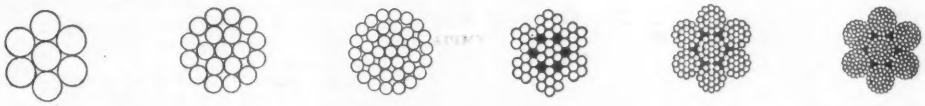
DOES YOUR RIGGING NEED ATTENTION?

The safety of your rigging is a most vital and essential matter calling for constant care.
MESSRS. GEO. CRADOCK & CO., LTD.—one of the leading flexible wire rope makers in Great Britain, make a speciality of the most suitable

FLEXIBLE STEEL WIRE STRANDS, CORDS, &c., FOR RIGGING AERIAL CRAFT,

and any requirements in this direction should be supplied by them.

The following illustrations are Sectional Views of some of the flexible strands and cords made by them.



7 Wires. 19 Wires. 37 Wires. 49 Wires. 133 Wires. 259 Wires.

GEORGE CRADOCK & CO., LTD.,

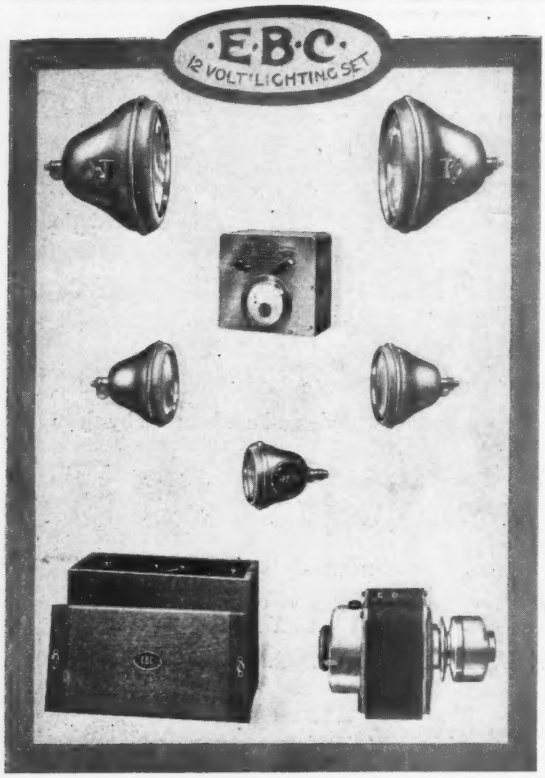
STEEL WIRE ROPE WORKS, WAKEFIELD, ENG.

Contractors to the Admiralty and War Office.

LONDON OFFICE :—7, East India Avenue, E.C.

Estimates, full details, and immediate and careful attention to all enquiries.

We have the longest experience in the trade in spinning Special Superfine Combed Yarns for manufacturers of Aircraft Fabric. We do not belong to any ring or combine. 263,000 Spindles.



THE ALL-BRITISH "E.B.C." DYNAMO LIGHTING SYSTEM.

Specially Designed Set for Light Cars.

FULLY GUARANTEED for TWELVE MONTHS.

SPECIFICATION

12 VOLT LIGHT CAR SET.

DYNAMO. Output 75 watts, 12 volts 6 amperes, with pulley fitted with B.S.A. free wheel.
SWITCHBOARD. Fitted with polished and lacquered metal front, combination switches and ammeter.
ACCUMULATOR. 12 volts 24 ampere hour actual capacity, in acid-proofed case for fitting to running board of car.
TWO HEADLIGHTS. 7½ in. fronts, fitted with adjustable focussing holders and 12 volt bulbs.
TWO SIDELAMPS (complete with Bulbs). Torpedo model side lamps can be supplied at same price if desired.
ONE TAIL LAMP (complete with Bulb).

PRICE, complete Equipment, £20.
BRASS FINISH.

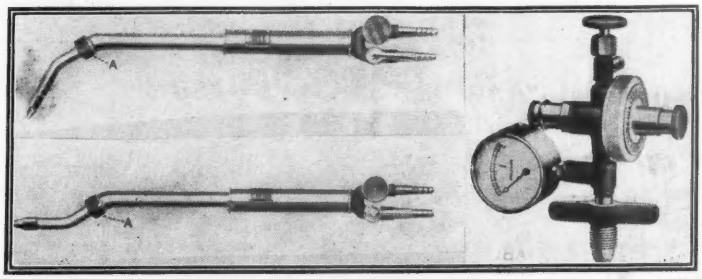
6 volt Set, same as above Specification, but with 6 volt 50 watt Dynamo and 6 volt 33 ampere hour Accumulator.

PRICE, complete Equipment, £18.

Sole Manufacturers and Patentees:

THE ELECTRIC BATTERY CO.,
DYNAMO AND ACCUMULATOR MANUFACTURERS,
62, EAGLE STREET, HIGH HOLBORN, LONDON, W.C.

pipe, two types of which are shown, and the Endurance automatic regulator. With regard to the former, by simply screwing back the milled nut the bent nozzle head can be removed and all essential parts of the



Two universal blow-pipes and the automatic regulator used in the Oxy-acetylene welding system of the British Oxygen Co.

blowpipe inspected. It is claimed that with this type of blowpipe back firing of the flame is practically prevented so that periodical cleaning due to sooting up of internal parts is rarely required. The automatic regulator will reduce the high and varying pressure of oxygen from the cylinder to any required low pressure from zero to 40 lbs. per sq. in., the maximum blowpipe pressure required. The adjustable screwed socket is graduated in lbs. per sq. in., and the regulator can be set by this means to any desired constant pressure enabling the usual low pressure gauge to be dispensed with.

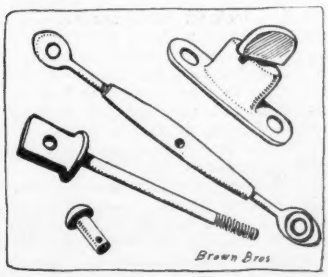
Those who are thinking of installing such a system in their works will doubtless find it worth their while to send for a catalogue, which contains much general useful information on the subject.

British Petroleum Co., 22, FENCHURCH STREET, E.C.

"FAMILIARITY breeds contempt" may be true in the general run of things but it certainly is not so with regard to "Shell" motor spirit, which is respected more and more by aviators and motorists as time goes on. It would be idle to dwell upon its merits, as they are so well known, and especially in view of the fact that practically every aviation record has been made by the aid of "Shell."

Brown Bros., Ltd., GREAT EASTERN STREET, LONDON, E.C.

IT would be impossible to enumerate here all the aero accessories supplied by this well-known firm, for it would not be an exaggeration to say that practically any im-



Some aircraft fittings supplied by Messrs. Brown Brothers.

portant accessory or fitting can be obtained from them, as the following selection will show :—Five-armed (aluminium centres) steering wheels ; aeroplane wheels and tyres ; turnbuckles, steel eyebolts, and metric bolts ; control levers (R.A.F. specification) and control wires ; steel tittle pins for yoke ends of turnbuckles ; brass water hose clips ; thimbles ; canopy buttons and eyelets ; piston rings ; twill, canvas and leather upholstery, with studs, banding and pipings ; hubs, spokes and nipples for wheel building ; accumulators in all types ; dashboard lamps for instrument lighting ; tumbler switches ; lamp holders ; indestructible rubber petrol piping ; Brooks' B 170 saddles, suitable for armoured car work ; sparking plugs ; Gnome engine copper and asbestos washers, all sizes supplied to order ; canvas water-carrying buckets (2-gallon) ; fabric brake lining in their well-known "Raybestos" ; driving chains ; electrical fittings ; aluminium sheeting in all sizes and gauges ; brass and copper foil, sheet and strip ; steel, brass, and copper tubing of all dimensions ; union drawn screwing and cutting steel of every dimension, &c.

Besides supplying most of the various aeroplane builders, they are contractors to the R.F.C., R.A.F., R.N.A.S.; Central Flying School, &c.

R. Cattle, 27, WYBERT STREET, STANHOPE STREET, LONDON, N.W.

BESIDES supplying wood in the "raw" for aircraft, R. Cattle and Co., a firm of over forty years' standing, also specialise in finished parts, such as ribs, spars, struts (hollow or solid), fairings, &c., all of which are machined up to exact size and section to pass Government inspection. They have a very fine wood-working plant—most of which has been designed and constructed by themselves—capable of turning out all kinds of work with the greatest degree of accuracy. It should also be noted that they carry a very large stock of silver spruce and ash specially suitable for use in the construction of aircraft.

Cellon, Ltd., BROAD STREET HOUSE, NEW BROAD STREET.

THAT the slogan adopted by this firm with regard to its product, "The dope of proved efficiency," is no idle boast is shown by the fact that the demand for Cellon is continually increasing. Another confirmation is also provided by the fact that several of the leading firms of constructors have arranged for a constant supply of Cellon to be delivered at regular periods. Among the largest users of Cellon are the two British flying services. It is almost unnecessary to add, therefore, that Cellon can be had to comply with the Government requirements as well as other grades to meet special needs.

T. W. K. Clarke and Co., Ltd., HIGH STREET, HAMPTON WICK.

MESSRS. T. W. K. CLARKE being now employed mostly on Government work, making acetylene welded and tinned fittings for various machines of R.A.F. design, are not making any special accessories of their own. They have, however, recently established a separate works for propeller making which is now in full going order. Here they are in a position to undertake work for private firms, such as school or experimental propellers, in addition to turning out propellers to standard designs, work in which they have had considerable experience in the past.

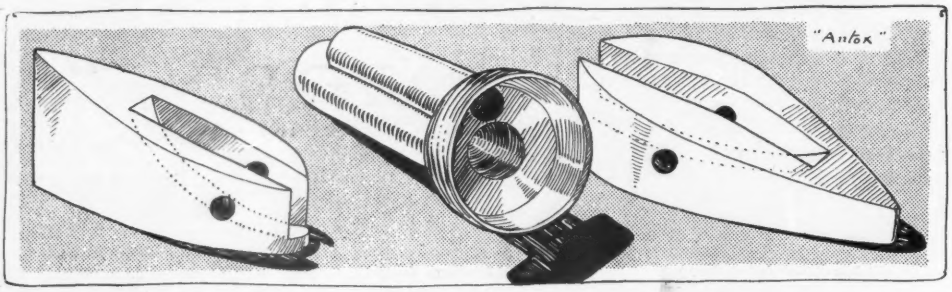
R. W. Coan, 219C, GOSWELL ROAD, LONDON, E.C.

IN their own particular sphere there is perhaps no name that is better known throughout the length and breadth of the kingdom than that of Coan, who, as all the world is by this time aware, casts clean crank cases, not to mention innumerable other aluminium objects and parts connected with the automobile and aeronautical industries. It may be said that the work turned out by this firm is in quality and finish unsurpassed, and that no job is either too small or too great for them to undertake. This is equally true of repair work, which indeed forms a large part of their commercial activities, while the latter, moreover, are not by any means confined to the needs of the two industries above mentioned, the requirement of *all* trades in this respect being catered for.

A load of Cellon, being part of an Admiralty contract.

The Combined Metal and Reinforced Casting Co., Ltd., POINT PLEASANT WORKS, WANDSWORTH, LONDON, S.W.

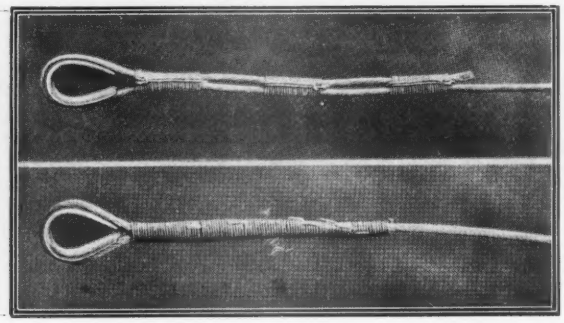
IN spite of the very large extensions of their foundry and rolling plant the rapid growth of the business, especially in connection with Government work, has necessitated still further extensions to the works of this firm. They are now putting down a large machinery plant so that they will be in a position to execute orders for castings in all metal alloys, rolled sheet metal, machinery and polishing of all parts for aircraft and automobiles, such as gear boxes, carburettors, fans, &c. They are the sole manufacturers of "Antox," an aluminium alloy possessing maximum strength combined with minimum weight. "Antox," in the cast state, has a specific gravity of 2·65, and a tensile strength of 12 tons per sq. in., raised to 24 tons for rolled "Antox" and to 30 tons for wire. It also possesses the great advantage over aluminium of not being liable to the ill-effects due to the action of sea-water, &c.



Some samples of casting work in Antox by the Combined Metals Co

Geo. Cradock and Co., Ltd., WAKEFIELD.

THE question of strength in the cross bracing of an aeroplane is one of so great importance that nothing but the very best is good enough for this purpose. Messrs. Cradock and Co. have had long experience in the manufacture of wire rope, being fully equipped for its production from the pig-iron onwards. As the steel is prepared in their own furnaces, the rods rolled, and the wire drawn in their own shops, they are in a position to advise customers as to the most suitable quality and flexibility of rope for the work to be performed. The strands and cords tabulated in the firm's pamphlet, dealing with those most suitable for aviation purposes, are all composed of galvanised or plated steel wire of the highest quality. The stranded cords have a wire main core since a hemp core would absorb and retain moisture, whereas a wire strand in the centre has, of course, no tendency to do this. The core is spun the opposite way to the lay of the rope, thereby helping to retain the extra twist put into the stay when a single-threaded tightening screw is used. In the list of stranded cables suitable for aircraft are included flexible steel wire strands composed of 7, 19, and 37 wires, and with breaking strains ranging from 390 lbs. to 9,050 lbs., and flexible steel wire cords composed of 49, 133, and 259 wires, and with breaking strains ranging from 1,169 lbs. to 16,345 lbs.



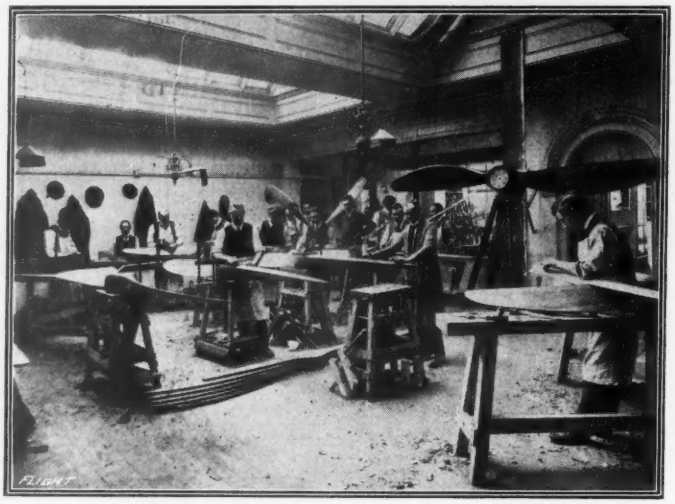
Two methods of securing the ends of Cradock steel wire strands.

Dunlop Rubber Co., ASTON CROSS, BIRMINGHAM.

TYRES for aeroplane wheels, in all the usual sizes, are of course made by the Dunlop Co., who in addition market several accessories which make for economy in the use of aeroplane tyres, a matter which does not always get the attention it deserves. The Dunlop pressure gauge is an admirable little appliance whereby the motorist can quickly ascertain the pressure of air in each tyre with far greater accuracy than the common method of kicking the tyre with the foot.

Ebora Propeller Co., 11 AND 12, SURBITON PARK TERRACE, KINGSTON-ON-THAMES.

AMONGST the aircraft firms that have rapidly gained a reputation for accurate and highly finished work is the Ebora Company. Started only half a year ago on a small scale, they soon found their works too small and had to look for better accommodation, which they found as above, where they now have established the different departments into which a modern propeller works is divided. At present they are extremely busy with four-bladed and two-bladed propellers of standard designs, as well as a number of experimental propellers of a new and highly interesting construction.



One of the shops of the Ebora Propeller Co.

In addition, propellers are built on a design evolved by the managing director, Mr. Jan Schiere, A.F.Ae.S., based on experiments made in the works and aerodynamical laboratories abroad. This type of propeller, to which the name Ebora has been given, has now been built for various types of engines up to 200 h.p.

For flying schools, where extreme lightness is an important factor, a special model of propeller has been constructed, and has proved a success.

HARRODS
LEATHER CLOTHING
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AVIATORS
MOTORING & MILITARY USE

The approved Naval Aviator's Chrome Leather Overcoat, lined warm Fleece throughout, in Black £4 19 6
Ditto, in Tan - - - £6 10 0
Black Leather Jacket, lined Flannel £2 15 0

The approved Aviator's Suit in Black Chrome Leather, lined Fleece throughout - - - - 8 Gns.
Ditto, in Tan - - - 9 Gns.
Cap, as illustrated, in Tan Chrome Leather - - - 6/6 to 21/0
Aviator's Special Lined Gauntlet Gloves - - - - 13/6

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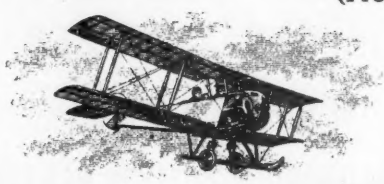
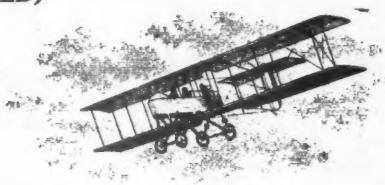
(Proprietor—G. H. MANSFIELD)



A S Coy.



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Wires: Upcast, Holb, London.

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WING FLAP HINGES.	BRT. HEX. BOLTS — AND NUTS —	METAL THREADS,	TURNBUCKLES
20-21-22/4029.	5×45 M/M., 5×65 M/M.	BRASS SCREWS	A.C.S.141.A B C.
1 GROSS PER WEEK.	IN TWO WEEKS.	IN STOCK.	1,200 IN STOCK.

LOOK OUT FOR OUR BULLETIN NEXT TUESDAY AND ENQUIRE ALWAYS OF

THE AIRCRAFT SUPPLIES COY., 17, JOHN STREET, THEOBALD'S ROAD, W.C.

Walter Brock on his return from Paris.

WON

London——— Manchester ———London.
London——— Brighton ———London.
London——— Paris ———London.

in 1914 using WAKEFIELD

GNOME-CASTROL.

C. C. WAKEFIELD & CO., WAKEFIELD HOUSE, CHEAPSIDE, LONDON, E.C.

C.D.C.

Petrol Resisting RUBBER Tubing

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As used by ADMIRALTY and GOVERNMENT CONTRACTORS.

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CASTINGS FOR AEROPLANE WORK A SPECIALITY.

CAST ALUMINIUM NUMBER PLATES

Bright Polished Figures, Beaded Edges, Dead Black Background.

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20/- per pair Carriage Paid.

Delivery in 24 hours.

Write for Trade Terms.

CONTRACTORS TO ADMIRALTY AND WAR OFFICE.

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THE ALUMINIUM FOUNDRY,
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LONDON.

Telephones— 3846 City. 4879 Central.

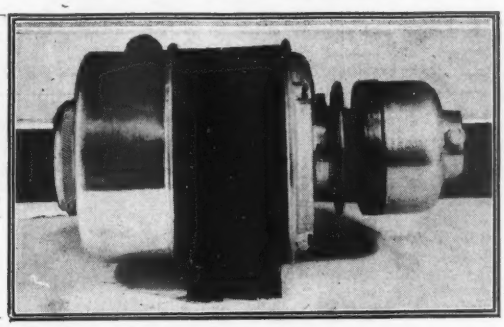
Telegrams— Krankases, Isling, London.

THE SOCIETY OF MOTOR MANUFACTURERS & TRADERS LTD.

When communicating with advertisers, mention of "Flight" will ensure special attention.

Electric Battery Co., 62, EAGLE STREET, HOLBORN, E.C.

A MODIFIED form of the well-known E.B.C. car lighting dynamo has recently been introduced, which is particularly adapted for use on aeroplanes, where its services in conjunction with a projector should be of inestimable value in night flying, as also for the illumination of the instrument board in front of the pilot, while another sphere of utility for such a machine is of course in connection with wireless work.



General view of the new light-weight E. B. C. dynamo, specially designed for use on aeroplanes.

The great feature of the machine is its light weight, being but 10 lbs. complete. This practically is the total weight of the whole plant necessary, except that of the lamps themselves, since the machine is intended to supply the current direct without accumulators. The question at once arises, however, as to whether, in view of the last statement, the projector would be of much utility when landing, since the engine would then probably be well throttled down and the light proportionately decreased in intensity. We are assured, however, that so long as the engine is running, whether driven by its own power or by air pressure on the propeller, the light is not appreciably less than when the engine is running at normal speeds, while for speeds above normal, of course, the automatic regulation of the voltage, inherent from the design of the machine, provides that the lamp filaments do not suffer from overloading.

The extreme lightness of the dynamo is the outcome of clever design in the employment of metal to its best purpose and by the use of aluminium for all those parts of the machine that may be described as being of a constructional rather than effective nature.

The Engineering Timber Co., Ltd., 9, VICTORIA STREET, S.W.

A SUDDEN increase in the demand for wood always carries with it the danger of a falling off in quality, and the best safeguard against this is to deal with firms who have had experience in the various branches of the timber trade and who, through their business connections, are in a position to ensure that their goods are grown under the most suitable climatic conditions, and, after cutting, have not been partly spoilt by having the drying process accelerated in the dry kiln. The Engineering Timber Co. hold large quantities of all the various sorts of wood used in the manufacture of aeroplanes, such as clear silver spruce in long lengths, West Virginia spruce and English ash, while they also have on hand a good stock of mahogany and walnut suitable for propeller making.

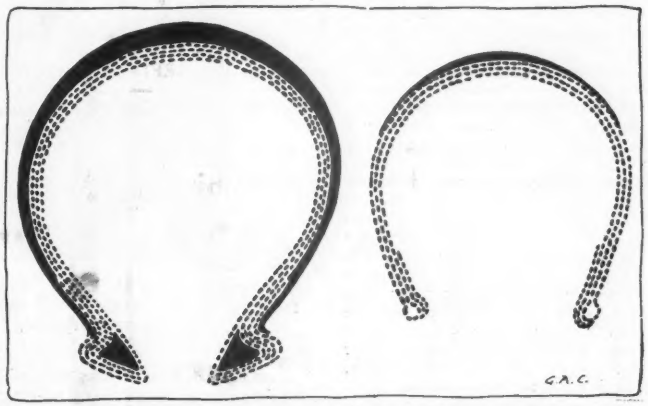
The Fairby Construction Co., Ltd., LONGFIELD, KENT.

THIS firm are designers and makers of steel construction factory buildings suitable for aircraft works, and of aeroplane sheds, the latter incorporating a new idea in doors. As aeroplanes grow in size, the question of suitable doors that can be easily opened becomes one of some importance, and for that reason alone the sheds produced by this firm will be well worth investigating, apart from any interest attaching to the buildings themselves. A further inducement to get into communication with this firm is that they include in their contracts a heavy penalty for each day the completion is overdue, so that aircraft manufacturers may always rely upon getting buildings finished on time when ordering them from the Fairby Construction Company.

The General Aeronautical Co., Ltd., 30, REGENT STREET, S.W.

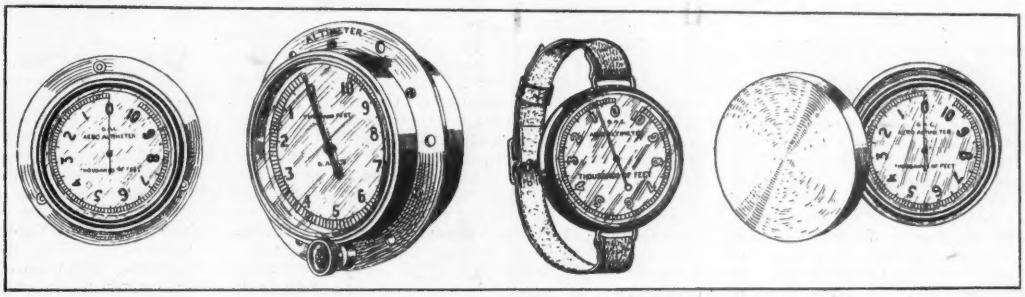
IN their new works at Hythe Road, Willesden Junction, which are now in full going order, the General Aeronautical Co., Ltd., have ample facilities for meeting the steadily increasing demand for their British made specialities. An extensive equipment of up-to-date machinery and machine tools have been laid down.

One branch of the business which is being rapidly developed is that devoted to the production of G.A.C. propellers, the firm having acquired the manufacturing rights for Great Britain of the Regy propellers, which have met with very great success in France. With the new facilities which they now have available the firm are specialising in the making of propellers to Government designs and other air-screws for Government machines. It need hardly be said in this connection that only the best materials are employed and every care taken to ensure that the workmanship is of the highest grade.



G.A.C. Aero Tyres.—That on the left is the beaded edge pattern, while the wired-on model to the right is the standard for Farman machines, &c.

Readers of "FLIGHT" are already familiar with the various styles of G.A.C. feather-



Some styles of the G.A.C. featherweight altimeters.

weight altimeters, which have acquired great popularity on account of their qualities of accuracy and lightness. The range of instruments practically covers every conceivable requirement, and the sketches show but one or two which are in the greatest demand. They are sold in several styles—for screwing on to the dashboard, for wearing on the wrist, and for carrying in the pocket or in a leather sling case, the last-mentioned being specially suitable for observers. All of them are distinguished by their lightness, the cases being made of aluminium, and in most styles they can be had with the figures treated with luminous radium, so as to be readable at night. One model, known as the standard aeroplane model, is made to the Government Mark IVA specification, and it can be had either with the usual white dial and with black figures, or a black dial with white luminous figures; the advantage of this is that it is clearly readable by day or night, and it has the advantage for day that it prevents any reflection of the sun's rays. Another instrument which is finding a good deal of favour with flying officers and others is a combined watch and compass for wearing on the wrist. The compass is mounted in the cover of the watch, and both the dial of the compass and that of the watch, together with the pointer and hands, are treated with luminous radium.

Flying officers and those who wish to make a present to a friend in the flying service will also be interested in the G.A.C. goggles, which are beautifully made to comfortably fit the face, the edges being lined with best quality plush while the eyepieces are made of Triplex glass, thus avoiding the danger of splintered glass in case of an accident.

The demand for G.A.C. aero wheels continues to be greater than ever, and an extensive plant has been installed at the new works for the building of them in greatly increased quantities. One of the standard 24 ins. by 3 ins. wheels was recently subjected to breaking strains, and was found to withstand a load of 3 tons before the spokes began to give. G.A.C. tyres, which are specially manufactured by Messrs. Spencer, Moulton & Co., of London and Bradford, can be obtained in all the usual sizes either in the beaded edge or wired-on patterns, the latter being standard on all Farman machines. G.A.C. inner tubes are made in two thicknesses, light and heavy, and strength for gauge are guaranteed unbeatable.

Our readers may be interested to learn that the G.A.C. can offer early deliveries of B.E. strainers.

On account of the congested state of the carriers at the present time the firm have found it necessary, in order to meet the pressing demands from some of their clients, to convert their Chenard-Walcker touring car into a lorry and it is rendering yeoman service, having already a good many thousands of miles to its credit and with some very good loads too.

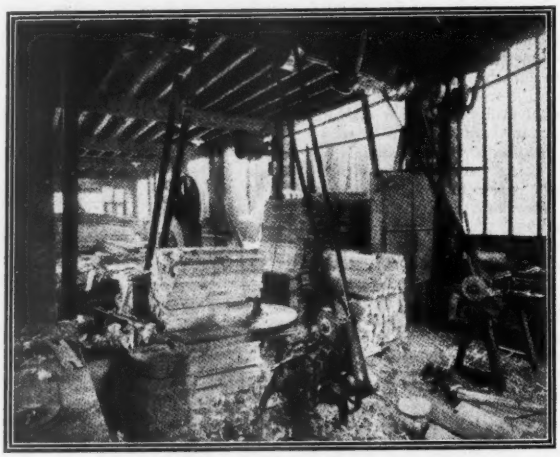
The General Electric Co., Ltd. 67, QUEEN VICTORIA STREET, E.C.

WITH their long experience, the General Electric Co. are in a position to carry out the complete electrification, electric lighting, and steam heating of factories of all descriptions. Different kinds of drive are desirable in different cases, though in a great many cases individual drive, *i.e.*, a special electric motor for each machine tool, is desirable on account of the niceties of control possible and the economy of running, as the motor is only working when the tool is in use. In some cases, however, it is better to adopt group driving, *i.e.*, to run machines from short lengths of shafting driven by electric motors.

The switchgear necessary for the control of electric power in factories must be of special construction to withstand the rough usage generally meted out to such gear, and certain rules and regulations issued by the Home Office have to be followed. The G.E.C. has specialised in this work, and can deal with any case which may arise whether it be for motor starters and controllers, main switches, sub-switches for lighting or power, circuit breakers and fuses, &c., as well as for complete equipments. Mention should be made of the bench drills, breast drills, grinders, &c., supplied by the G.E.C.

The adequate lighting of factories is a matter of great importance, and here the skilled assistance of the G.E.C. Illuminating Engineering Department will be found of service—this department having been formed some years ago to take up scientifically the question of lighting in all its aspects. No hard and fast rule can be drawn up, but the G.E.C. "Dalite" system can be adapted to any case, as direct, indirect, and semi-indirect lighting units are used according to circumstances, special units for factory use being available. The lamps used are Osram drawn wire lamps or Osram Atmos type lamps. These lamps are made at the Osram-Robertson Lamp Works, Hammersmith, London. Where small candlepower units are required Osram drawn wire lamps are considered to be the best, but where larger units are desirable Osram Atmos type lamps will be found to meet all requirements—a white light approximating to daylight being obtained.

For purposes of factory heating, the General Electric Co. supply combined steam heaters and electric propeller fans, two types being furnished, one low pressure and one high pressure. Both have a capacity of 2,600 cub. ft. of air per min. raised through 60° F. The General Electric Co. also make a speciality of ventilating installations, particularly for shops where doping is carried on.



Two examples of G.E.C. electric power installations.—Above, an individual motor driving a breast drill; below, a Witton motor driving a band saw, saw-sharpener, grinder, and spindle machine.

J. Gliksten and Son, Ltd., CARPENTERS ROAD, STRATFORD, LONDON, E.

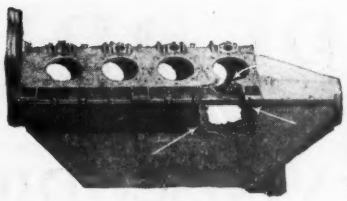
WITH a view to meeting the varied needs of aircraft manufacturers this firm hold extensive stocks of the woods mostly used in the manufacture of aeroplanes and propellers, including silver spruce, mahogany and walnut.

William Gschwind and Co., 211, DEANSGATE, MANCHESTER.

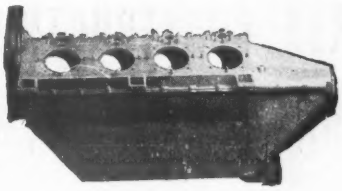
THIS firm, who are contractors to the British, French and Russian governments, make a speciality of high grade fine cotton fabrics suitable for the envelopes of balloons and airships as well as for the wing covering of aeroplanes.

The Hasler Telegraph Works, 26, VICTORIA STREET, WESTMINSTER, LONDON, S.W.

THE "Tel" aero-engine-revolution indicators which are now very extensively used by practically all the Allied Governments, are constructed on the same principle as the speed indicators and recorders made by the Hasler Telegraph Works for many years past, specially for use on locomotives, tramcars, and automobiles. These instruments have a mechanical action which differs entirely from the centrifugal or magnetic systems. The primary feature of the "Tel"



BARIMAR Scientific WELDING
Repairs all Metals. Every job Guaranteed



Barimar Triumphs in Aeroplane Repair Work

A long series of intricate and highly technical aeroplane repairs accepted under the famous Barimar Guarantee has won for the Service enthusiastic approval on every hand.

The job illustrated *is the repair of an aluminium crank-case from the 8 cyl. engine of a Curtiss Biplane, belonging to the well-known aviator Capt. Bass. The case was fractured on both sides of the bottom and one side of the top half, the break involving the cylinder base orifice. Perfectly repaired without the slightest distortion or trace of repair, the casing was delivered machined, faced up and all ready to refit. Some six months later the unit after giving every satisfaction was damaged in a fresh place and was returned for further treatment. The second repair is as completely effective as the first. Both jobs were done under Guarantee terms to make a perfect repair or refund every penny paid.*

Promptness is a feature of Barimar Service and moderate prices *always* obtain.

Send a trial job to-day—any damaged part of any aeroplane engine or metal gear of any kind. Send carriage paid direct to

BARIMAR LTD.,
Welding and Machine Shops,
10, Poland Street, London, W.
Telephone: 8173 Gerrard. Telegrams: "Bariquamar Ox, London."
Please mark specially all work for Admiralty or War Office.

Telephone: Gerrard 6824.
Telegrams: "Whitomoss, London."

WHITEMAN & MOSS, LD.,
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BRASS FABRIC TACKS	TURNBUCKLES (WIRE STRAINERS)
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ENQUIRIES SOLICITED AND PROMPT NOTIFICATION GIVEN AS TO ABILITY TO EXECUTE.

When communicating with advertisers, mention of "Flight" will ensure special attention.

FAIRBY CONSTRUCTION CO., LTD.,

117, VICTORIA STREET, S.W.

THERE IS NO CHANCE

of our finishing the "special" factory by the 23rd November and for a very good reason—a supplementary contract is about to be signed for a large addition to the original plan—and further buildings are in contemplation here but

WE DO NOT MIND REPEAT ORDERS.

Last week we were asked to delete our penalty and bonus clause—from a contract with a well known firm. They knew we were not afraid of a penalty of £30 a day and they did not want to pay us a bonus at such a rate.

WE MUST THEREFORE HAVE BUILT UP A REPUTATION

even in the comparatively short time we have been running. We do not profess to be an old firm — we specialise in the new methods for the new conditions the War has brought about.

TELEPHONE: 8868 VICTORIA.

SPERRY
Gyroscopic Stabilizer

in use on Machines of the British, Russian, and Italian Governments.

It incorporates a horizontal reference plane of accuracy and integrity to which all angles can be referred.

It is a reliable mechanical pilot of never-failing accuracy, capable of correcting disturbances at their inception.

Its use permits the selection of an aeroplane with the highest efficiency in speed and climbing capacity without regard to other factors.

It relieves the pilot of nervous and physical fatigue incident to flying, allowing him to make those observations for which an observer has hitherto been required.

Unlike the pilot, its efficiency is unaffected by fog or darkness.

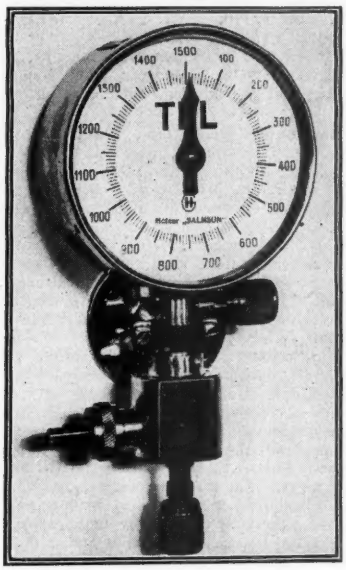
For these reasons it is the logical accessory to every military aeroplane.

THE SPERRY GYROSCOPE COMPANY, LTD.,

15, Victoria Street, London, S.W.

Telephone— Victoria 7398

indicator is that the indicating needle is reset by the mechanism every second so that every variation of speed is indicated accordingly. There are several models manufactured, differing only in detail fittings, according to



One of the Tel revolution indicators made by the Hasler Telegraph Works.

the type of engine, but all the same as regards mechanism. The calibrations are also varied to suit different conditions. Another Hasler instrument, which appeals more to manufacturers, is the "portable" revolution, circumference and cutting speeds indicator by means of which the number of r.p.m. of a revolving shaft, &c., is shown in three seconds without the aid of a watch.

Messrs. Wm. Heaton and Son, Ltd., LOSTOCK JUNCTION MILLS, LOSTOCK, NEAR BOLTON.

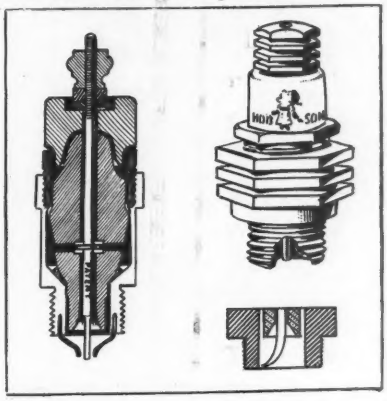
ONE example of the far-reaching demands of aircraft is shown by the fact that the yarns of which the fabric is made are now being specially spun in Lancashire. One of the first firms quick to grasp the possibilities in this direction was Messrs. Wm. Heaton and Sons, Ltd., who brought their 115 years' experience to bear in specialising in spinning superfine combed "Sea Island" yarns for such purposes, and official tests which have been conducted with the yarns have given splendid results at regards strength and elasticity. Aircraft fabric woven from these special yarns is used for the inner and outer coverings of airship envelopes, coverings for seaplanes, and it is also now being adopted in place of linen for aeroplane work. At their mills at Lostock and Doffcocker, near Bolton, the firm now operate 263,000 spindles, and the counts spun in the mills range from 50's up to 300's twist and weft. The yarns have been subjected to the severest official tests, and have proved to have the maximum amount of strength with elasticity.

Hewlett and Blondeau, OMNIA WORKS, LEAGRAVE, BEDS.

APART from the building of aeroplanes, Messrs. Hewlett and Blondeau make a speciality of supplying the necessary fittings, for which purpose they have put down an extensive plant at their new works. The quality of their work is shown by the fact that it is impossible to keep pace with the demand, especially for strainers and bolts to Government specifications. They keep a fair stock of washers, ferrules, steel and brass thimbles, both of H. and B. designs and to R.A.F. specifications.

H. M. Hobson, Ltd., 29, VAUXHALL BRIDGE ROAD, LONDON, S.W.

SEVERAL types of plugs suitable for use on aero engines under various conditions are produced by Messrs. H. M. Hobson, and the fact that these plugs are used almost extensively for certain particular types of aero engines by the British, French, Italian, and other Governments, is sufficient proof of their reliability. The main feature of the standard Hobson plug is that the insulator (porcelain) is in three sections, and the electrode is entirely separate from the insulator. The various parts are thus able



Various styles of Hobson plugs for aero engines, that on the right being for rotary motors.

to expand and contract independently of each other. This construction is shown in the accompanying sketch. The different types of Hobson plugs are as follows: 14 Ae. single-gap electrodes, 14 B double-gap suitable for Salmson engines, 14 I.P. single-gap "skirted" suitable for hot and high compression engines. 13 small size, two porcelain insulators suitable for Green and water-cooled engines. There are also two plugs designed for rotary engines, one having cooling fins formed on the body, and another plug with a mica-porcelain insulation capable of withstanding much rough usage. Another Hobson line consists of insulated and water-tight "push on" terminals.

The "Integral" Propeller Co., Ltd., 1B, ELTHORNE ROAD, UPPER HOLLOWAY.

JUSTLY famous for the fact that they have been fitted to so many of the machines which have established world's records, Integral (Chauvière) propellers have won a much more lasting reputation for good workmanship and accuracy of design, and it is not surprising therefore that they are so extensively used on British naval and military machines. Not only are they made of the best selected wood, but special attention is paid to the grain of the wood, which runs straight from one tip of the propeller to the other. In addition, by the use of special testing machines, every care is taken to ensure that Integral propellers are perfectly balanced so as to eliminate any possibility of vibration, that is so detrimental to the running of the engine. Apart from the propellers for land machines, the firm makes special propellers for seaplanes, with the tips protected against damage from flying spray by means of brass sheaths securely riveted. For use on dirigible airships a special propeller is produced in which the pitch can be varied during flight.

In order to cope with the ever-increasing demand for Integral propellers new premises have been acquired at Hendon, equipped with the most up-to-date machinery for propeller manufacture. As a large stock of Integral propellers of all sizes and pitches is kept on hand delivery can generally be made at shortest possible notice.

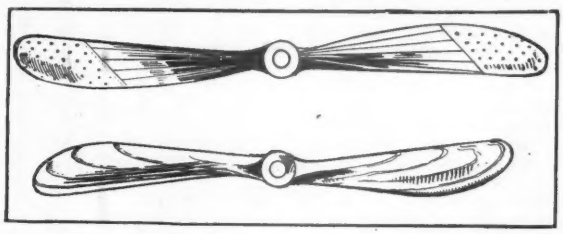
At their extensive works in Paris the company are able to undertake to manufacture and give deliveries of all types of metal bosses for aero motors, a branch of the business which is now being rapidly developed.

The Improved Liquid Glues Co., Ltd., GREAT HERMITAGE STREET, LONDON, E.C.

OUR readers are already familiar with "Croid" glue which is advocated as most suitable for use in connection with aircraft. "Croid" is a liquid cold glue, and although it only requires the addition of cold water to be ready for use it is claimed to possess great strength and lasting properties, and has certainly given excellent results under test. A 9-in. length of teak 2 ins. square glued with "Croid" end grain to another piece carried a suspended weight of 282 lbs. before the joint gave, which is equivalent to a breaking strain of 5½ cwt. per sq. in. This glue is specially recommended for use in connection with propellers. The advantage is that it does not "chill" in cold weather and it will not stain the fingers. It is obtainable in convenient form, either in ¼ lb. to 1 cwt. tins or in tubes (small 1*d.*, large 6*d.*).

Kelvin, Bottomley, and Baird, Ltd., 16–20, CAMBRIDGE STREET, GLASGOW.

THIS firm's specialities consist of the Lord Kelvin (Sir William Thomson) navigational and electrical instruments, including compasses specially designed for aircraft. These latter instruments are of various types, standard Admiralty and War Office pattern, and ordinary models. That shown on the right of our illustration is the standard airship compass. The case, hood, and mounts



Two Integral propellers, that at the top being for seaplane work.

are all made of aluminium finished dull matt black, and the windows are made of celluloid. The bowl is fitted with a special shock-

absorbing device registered lubber screw, which is also shown in magnified image. The lighting for night work is provided for by an electric lamp in the hood. The other instrument illustrated is an observer's compass, which is worn on the wrist or knee, and is illuminated by a small electric bulb embodied in the compass case, the battery being of the pocket type. The standard aeroplane compass has a hood with sliding doors, and a course indicator mounted on the rim of case inside. The case, hood, and mounts are made of brass finished dull, and provision is made for lighting the compass by means of a dry cell mounted outside the compass case.

An observer's compass for wearing on wrist or knee, and the standard airship compass made by Kelvin, Bottomley, and Baird, Ltd.

Kroll and Co., BAYHAM PLACE, CAMDEN TOWN, LONDON, N.W.

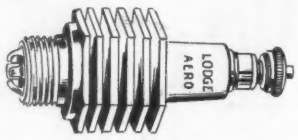
MESSRS. KROLL AND CO., who are well known in the automobile world in connection with sheet metal work, have recently opened out in the production of metal fittings and parts for aircraft. With their previous extensive experience in metal work behind them, they have been able to build up a position to undertake all kinds of metal work for aircraft, ensuring large and speedy production with the greatest possible degree of accuracy.

Lang Propeller, Ltd., WEYBRIDGE, SURREY.

MAKERS of the well-known Lang propellers that have been used with such great success by a number of leading aviators during the last three years, this firm has a large stock of Lang propellers, which are invariably of the very best workmanship and well designed. Special types for experimental machines can be delivered at a few days' notice, and they are at all times willing to lend their aid to builders in finding a suitable propeller for a new machine.

The Lodge Sparking Plug Co., Ltd., WRENTHAM STREET, BIRMINGHAM.

HAVING made a name for their sparking plugs for automobiles, it is not surprising that the Lodge Sparking Plug Co., Ltd., have been equally successful with sparking plugs for aero engines. Although under certain circumstances the ordinary sparking plug may be used for aero engines, there are conditions under which the ordinary plug cannot hold out, and so a special pattern has to be produced. One of such that has been manufactured by the Lodge Co. has withstood most trying and exacting tests working under long continuous full load conditions. The insulation is of mica, and the body of the plug has large cooling fins formed on it.



A Lodge sparking plug for aero engines.

W. Lester, 10, HAM YARD, SHAFTESBURY AVENUE, W.C.

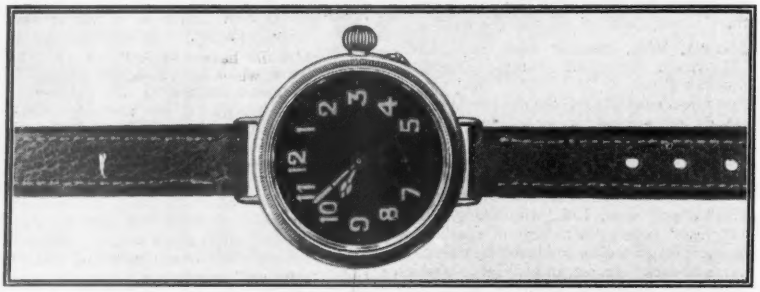
CAN give quick delivery of all fittings, undertakes metal press work, metal stamping, metal jig sawing, and can furnish blanks of any size and thickness.

The London Label Co., Ltd., BECTON ROAD, PLAISTOW, LONDON, E.

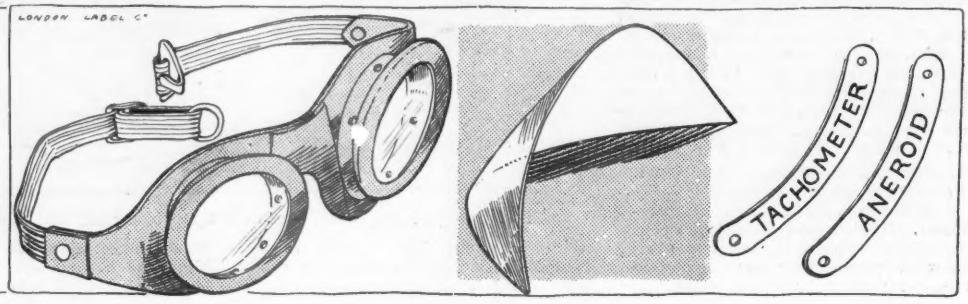
AMONGST the various specialities, applicable to aircraft, manufactured by the above firm, some of which are illustrated by the accompanying sketches, are all kinds of labels for instrument boards, dials for compasses, transparent wind shields and map-covers, and goggles. The latter are strongly made of best red rubber, and are reinforced in all the places where breakage is likely to occur. The eye-pieces are made of Non-Flam transparent celluloid, which are not only fire proof but are unaffected by oil and petrol. It is claimed that they will not crack or splinter, and will always retain their transparency. The wind shield, illustrated, is made of the same material, and is cut exactly to R.A.F. specifications for B.E. 2c machines. The map covers are also of Non-Flam celluloid, 1 mm. thick, having lines, in red, accurately cut into the material forming 1 in. square. The name and address plates, title and instruction labels for the various instruments on the dash boards can be made in metal, ivorine, celluloid, bonite, &c.

Mappin and Webb, Ltd., REGENT STREET, W.

THIS well-known firm of silversmiths have by no means neglected the aviator, for amongst their comprehensive range of watches, clocks, &c., will be found several that will meet their requirements. One of these, a wrist watch, is shown in the accompanying illustration. This watch has a solid silver case with screw bezel. The dial is black with bold, luminous figures, enabling



A wrist watch with luminous figures, a speciality of Messrs. Mappin and Webb.



The goggles, windshield, and instrument labels are made from Non-flam. sheets by the London Label Co.

the time to be read with the greatest ease, either by day or night. The price of this useful article, which makes a very acceptable present, is £3.

Wm. Mallinson and Sons, Ltd., 130 TO 138, HACKNEY ROAD.

THESE well-known timber and veneer merchants and importers of American hardwoods hold large stocks of all the usual woods used in aeroplane construction, and their high standing is sufficient guarantee that timbers bought from them will be of the best quality and well-seasoned. In addition to the ordinary woods, this firm make a speciality of plywood, for the making of which they have a large factory at Laburnum Street, Kingsland Road. Here they make up, among other styles, the waterproof plywood asked for in the R.A.F. specifications, a branch of the business which is assuming large proportions.

Marsh Brothers, POND STEEL WORKS, SHEFFIELD,

SUPPLY steel tension wire of all gauges and strengths, suitable for aeroplanes, gliders and other aircraft. In addition they keep in stock all kinds of engineers' tool steel, twist drills, hack saw blades, &c.

Menday Motor Components Co., Ltd., CROWN WORKS, GATTON ROAD, UPPER TOOTING ROAD, S.W.

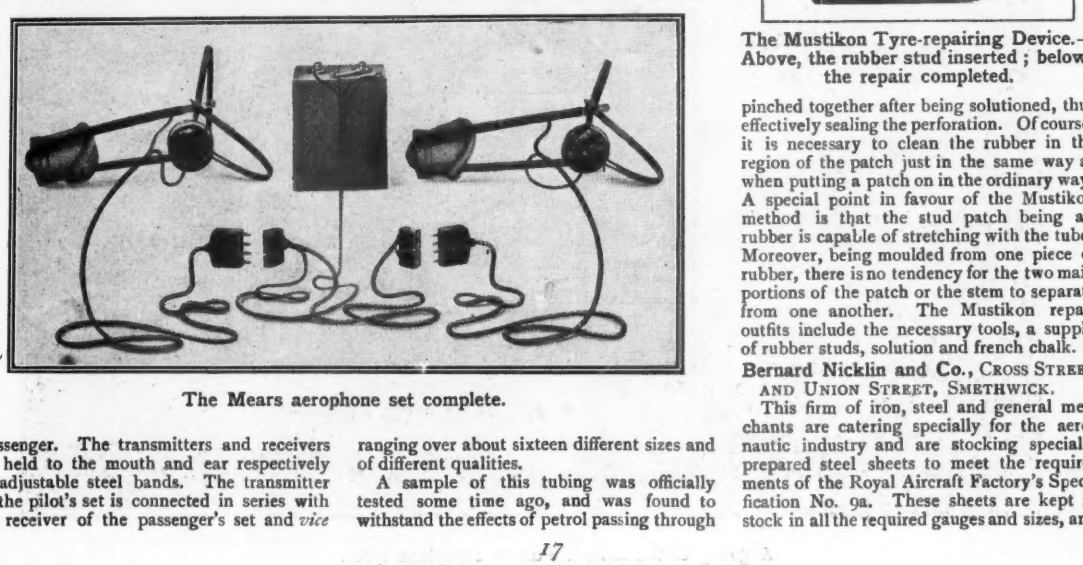
THIS firm of general engineers make a speciality of metal propeller bosses for every make of engine.

The Mears Ear Phone Co. (London), Ltd., 193, REGENT STREET, W.

THE advantage of a method by which the pilot of an aeroplane is enabled to carry on conversation with his passenger in a more convenient and comprehensive manner than by means of the somewhat primitive system of deaf and dumb signalling which usually has to suffice, is too obvious to need enlarging upon. Owing to the (in most cases) deafening roar of a high-powered engine telephonic communication between pilot and passenger offers considerable difficulties, but that these may be overcome has been demonstrated by Mr. L. G. Hammer, of the Mears Ear Phone Co., whose "Aerophone" appears to make such conversation possible.

This apparatus consists of two microphone transmitters and two receivers, one set being worn by the pilot and the other by the passenger. The transmitters and receivers are held to the mouth and ear respectively by adjustable steel bands. The transmitter of the pilot's set is connected in series with the receiver of the passenger's set and *vice versa*. The receivers are provided with a switch by means of which the volume of sound may be regulated to four or eight different degrees of strength according to individual ability of hearing and the noise made by the engine. Attached to the framework of the aeroplane are two sockets adapted to receive corresponding plugs. These sockets are connected by an insulated wire, and also to the battery furnishing the necessary current. The terminals of the plugs are connected by similar wires to the two sets of transmitters and receivers.

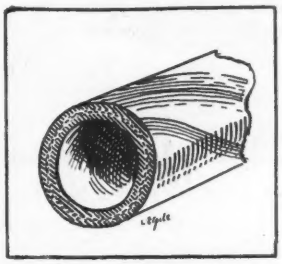
In order to exclude external noise the bell-shaped mouthpiece of the transmitter is provided, where it comes in contact with the wearer's face, with a pneumatic cushion which further serves to protect the wearer in case of accident. The whole outfit is very light, and can be quickly mounted on any machine.



The Mears aerophone set complete.

Mestre and Blatge, 20, STORE STREET, TOTTENHAM COURT ROAD, W.C.

THE question of a suitable flexible connection for petrol leads on an aeroplane is one of considerable importance and a problem not readily solved. Owing to its extensive employment for other purposes rubber tubing was one of the first to be tried, but it was soon found to have a highly detrimental effect on the rubber. The makers of the original petrol resisting rubber tubing *L'Etoile* have constantly improved their product, which is now recognized to be in the very front rank. Messrs. Mestre and Blatge, who are the sole agents in this country for *L'Etoile*, hold a very large stock of different qualities.



A sample of L'Etoile tubing.

A sample of this tubing was officially tested some time ago, and was found to withstand the effects of petrol passing through it for nearly 300 hours continuously. A sample of ordinary rubber tubing similarly tested was found to be gelatinated after only about nine hours. Although *L'Etoile* tubing is of French manufacture its application to unions of British sizes presents no difficulties, since, when ordering stating the size of the union, the nearest smaller metric size is supplied, giving just the right tight fit. The accompanying sketch will give some idea of the construction of this tubing, which is made up of two layers of specially-treated rubber, between which is a layer of cotton fabric.

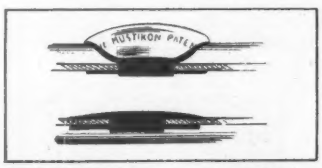
Messrs. Mestre and Blatge also sell an aluminium solder which has proved very successful.

Motor Radiators, Ltd., 80, FAROE ROAD, BLYTHE ROAD, HAMMERSMITH.

WITH the increase in size of aeroplanes and aeroplane engines has come the more extensive use of water-cooled motors. The question of a suitable radiator therefore becomes one of importance, and the requirements of aero radiators are naturally somewhat different from those obtaining in motor car practice. Thus the question of weight and head resistance for a given cooling surface has to be given every attention. Motor Radiators, Ltd. are the makers of light aeroplane radiators for all the various types of water-cooled engines in use, and aeroplane constructors who are beginning to fit this type would do well to communicate with this firm.

Mustikon, Ltd., 20, NEW STREET, CARDIFF.

PROGRESS in the art of repairing tyres still goes on, and whereas a few years ago it was thought that the vulcanising plant was the only repair agency for punctures and bursts, several ingenious devices have been produced to meet the demand for a quicker method of repair. The latest development in this direction is known as the Mustikon, and its method of application is clearly shown in the sketches. In the case of a puncture, a round hole is made with the special cutting tool, the Mustikon rubber stud is inserted and the two surfaces are pinched together after being solutioned, thus effectively sealing the perforation. Of course, it is necessary to clean the rubber in the region of the patch just in the same way as when putting a patch on in the ordinary way. A special point in favour of the Mustikon method is that the stud patch being all rubber is capable of stretching with the tube. Moreover, being moulded from one piece of rubber, there is no tendency for the two main portions of the patch or the stem to separate from one another. The Mustikon repair outfits include the necessary tools, a supply of rubber studs, solution and french chalk.



The Mustikon Tyre-repairing Device.—Above, the rubber stud inserted; below, the repair completed.

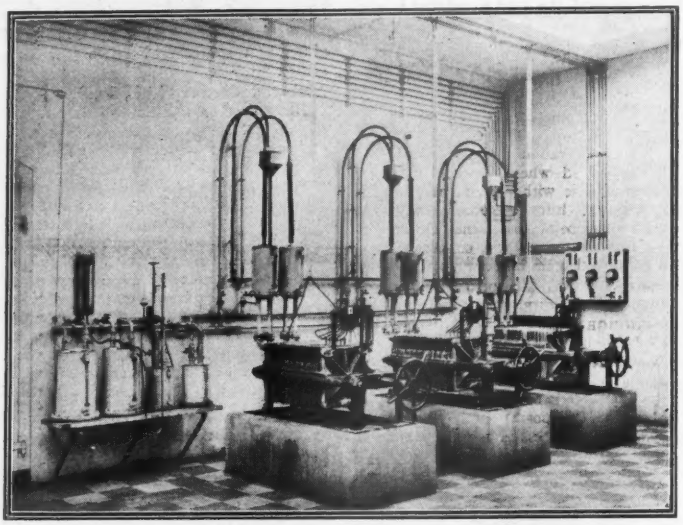
Bernard Nicklin and Co., CROSS STREET AND UNION STREET, SMETHWICK.

This firm of iron, steel and general merchants are catering specially for the aeronautic industry and are stocking specially prepared steel sheets to meet the requirements of the Royal Aircraft Factory's Specification No. 9a. These sheets are kept in stock in all the required gauges and sizes, and

in most cases can be despatched promptly, a fact which has proved a means of great assistance to several aeroplene manufacturers recently. We also understand that these sheets are also supplied direct to the Royal Aircraft Factory at Farnborough.

Maschinenfabril Oerlikon (Switzerland), OSWALDESTRE HOUSE, NORFOLK STREET, STRAND, LONDON, W.C.

THE production of hydrogen and oxygen forms a by no means unimportant item in the aeronautical industry, for hydrogen is, of course, required for dirigibles and balloons, whilst both hydrogen and oxygen are extensively used in connection with autogenous metal work—welding, or fusing and cutting. The most effective and best-known method of hydrogen and oxygen production is that in which water is decomposed electrolytically, and it is this method that is employed in the Oerlikon system. A large number of Oerlikon electrolyser plants are now in use, not only in the aeronautical industry but in others, such as metallic filament lamp factories, oil refineries, &c, and a large installation is in use at the Royal Aircraft Factory at Farnborough. This system is specially recommended in cases where an already existing source of power, which is not working at its full capacity, is available for the working of the electrolysers. A very complete plant for welding, &c., can be obtained, consisting of an electrolyser with standard accessories and switchboard, two low-pressure gasometers (hydrogen and oxygen), two belt-driven gas compressors, low and high pressure piping, and the usual welding and cutting apparatus. The whole plant calls for the minimum amount of attention (gas analysis and filling up of electrolyser three times per day), and the gas compressors work continually, the output being in proportion to the gas consumption.



A complete Oerlikon hydrogen and oxygen electrolysing plant.

Omnium Central, 175, SHAFTESBURY AVENUE, LONDON, W.C.

THIS firm possess facilities for the manufacture of all classes of highest grade engineering work for aeroplane engines, particularly of the rotary type, as well as the provision of spare parts, &c. They are also agents for best quality French propellers, tachimeters, and other fittings and accessories.

Opel Motors, Ltd., HALKIN STREET, HYDE PARK, S.W.

HAVE ample facilities for the complete overhaul of aircraft engines of all types and sizes, a work in which they have already made a splendid name for themselves. A staff of expert mechanics are continually engaged on work of this character, and the engines which have passed through their hands have ranged from 35 to 300 h.p.

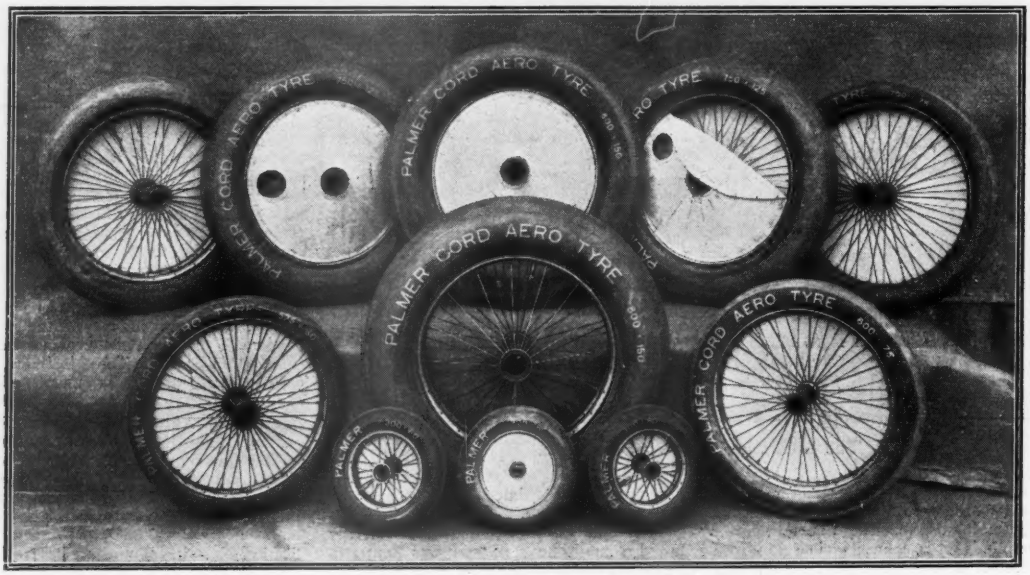
Joseph Owen and Sons, Ltd., TIMBER MERCHANTS, BOROUGH SAWMILLS, 199A, BOROUGH HIGH STREET, S.E.

THIS firm are the importers of clear silver spruce suitable for aeroplane and seaplane work, and number amongst their customers the leading builders in the country, as well as the Royal Aircraft Factory at Farnborough. They also hold good stocks of mahogany and walnut specially selected for propellers, and make a speciality of clean, straight English ash; also poplar, three-ply, &c.

In passing, it is of interest to note that their London yard is on the site of the Old Marshalsea Prison, and is visited by large numbers of American and other tourists interested in the works of Dickens.

Palmer Tyre, Ltd., SHAFTESBURY AVENUE, W.C.

ONE of the first firms which realised the arduous conditions under which aeroplane wheels and tyres have to work, Messrs. Palmer Tyre Ltd., by long-continued experiments and tests, have produced a special wheel and tyre which have given extraordinary results. They have also laid themselves out to meet the greatly-increased demand for these wheels and tyres, which can



A group of the famous Palmer aeroplane tyres.

now be obtained in the following standard sizes and dimensions:—

Tyre Sizes.	Wheel No.	Hub. Length. mm.	Hub. Bore. mm.	Track.
300 × 60	16	111·12	25·4	Central
	17	72·39	12·75	Central
450 × 60	30	89	31·75	Central
575 × 60	12	150	31·75	104/46
	14	150	38·1	104/46
	21	160	28	Central
600 × 75	12	150	31·75	104/46
	14	150	38·1	104/46
	21	160	28	Central
700 × 75	9	178	44·45	132/46
	20	178	38·1	132/46
700 × 100	18	178	44·45	132/46
	2	185	55	135/50
	26	150	40	Central
	4	185	55	Central
750 × 125	18	178	44·45	132/46
	2	185	55	135/50
	26	150	40	Central
	4	185	55	Central
800 × 150	8	185	55	135/50
	10	185	55	Central
	23	185	55	135/50

Thomas Parsons and Sons, 315-317, OXFORD STREET, LONDON, W.

IT is a generally accepted fact that the durability of plane fabrics can be considerably improved by giving them an outer covering of varnish or paint, over the dope. Much depends, however, on the nature of the outer coating applied, for this must be of such a composition that it will not chemically or otherwise affect the dope and fabric. In fact more harm than good would be done by applying an unsuitable varnish or paint, and the life of the fabric rendered shorter than if it were doped only. Having had over 100 years' experience of paints and varnishes, Messrs. Thos. Parsons and Sons are entitled to take a prominent position in the aviation industry, which they have but recently joined, for the purpose of supplying the right kinds of paints and varnishes to meet the conditions referred to above. Such is their speciality; varnishes suitable for all requirements, and paints in any colour, from tints you could see miles off to others that are all but invisible! In addition the firm supply paints and varnishes for any purpose whatever.

The Putney Foundry, 207, PUTNEY BRIDGE ROAD, LONDON, S.W.

THE Putney Foundry, which is a comparatively recent arrival in the industry, undertakes castings of all kinds, in aluminium, brass, and gunmetal, aeroplane and motor castings being a speciality. A few of the castings, picked out at random, which they are now turning out for aircraft are shown in our illustration in order to indicate the type of work undertaken. One of the features of the work is that they are exceptionally clean and sound.

Proctor's Garage, Ltd., PARLIAMENT MANSIONS, ORCHARD STREET, WESTMINSTER, S.W.,

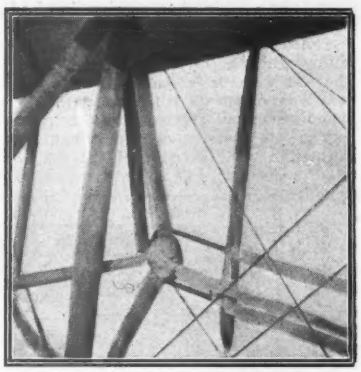
HAVE a speciality in an aluminium solder, which is known as the "A.B.C." aluminium solder, which is meeting with a considerable amount of success.

This solder is the result of a long series of experiments, and the best proof that it is a really good article is shown in the continuous number of repeat orders which are received from numerous well-known manufacturers who have used the solder for a considerable time.

There is one claim in particular which the makers wish to emphasise, and that is that no elaborate preparation of the articles to be joined is required when A.B.C. solder is used (as is the case with some others which have been put forth for aluminium work), all that is necessary being to see that the article should be quite free of acid or grease. A further point is that no flux is required.

Hans Renold, Ltd., BURNAGE WORKS, DIDSBURY, MANCHESTER.

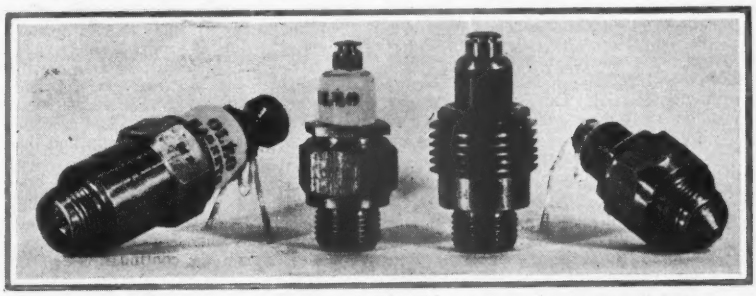
ALTHOUGH at the present time chains are not largely used for transmission purposes on aeroplanes, Messrs. Hans Renold are giving the matter full attention and bringing their wide experience to bear in producing suitable chains for the purpose. That they have already proved successful is shown by the photograph illustrating the transmission by Renold chain on the Mann biplane. The photograph was taken in the air, when the speed of the chain was 2,200 ft. per min. The pitch of this chain was 1 in., the width inside ⅝ in., the breaking strength 7,800 lbs., weight per foot 1·1 lb.; the horse-power transmitted was about 70. The firm are now experimenting with a view to producing a chain by which without increasing the weight or size appreciably powers of 100 and even more may be transmitted.



The Renold chain transmission on the Mann biplane.

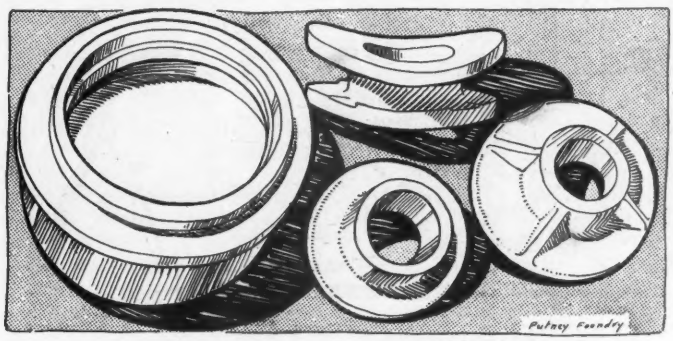
Leo Ripault and Co., 64A, POLAND STREET, LONDON, W.

THE makers of the famous "Oleo" plugs were one of the earliest firms to cater specially for aviation work, and they now have several types of aviation plugs, giving excellent results on aircraft in the service of the Allied Governments. The best known Oleo plugs are those used on Gnome, Le Rhone, Clerget and other rotary engines.



Some of the Oleo aviation sparking plugs for aircraft supplied by Messrs. Leo Ripault and Co.

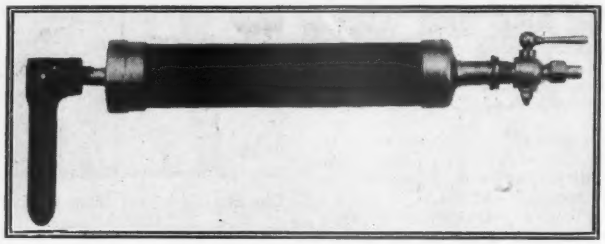
These plugs, which are made with either mica or porcelain insulations, are of simple construction, having a steel body, nickel central electrode and a one-piece insulator. There are three different arrangements of spark gaps, one (No. 2a porcelain) in which the end of the electrode is bent towards the wall of plug, another (mica) in which the body of the plug terminates in a cone with the apex cut to form an annular space round the central electrode, and the other type having three "points" inside the body bent up towards the central electrode. This latter plug also has ribs formed on the hexagonal sides of the body. A large plug for stationary engines is No. 7. This has a deep steel body, two porcelain insulators and a nickel electrode. A space is provided between the latter and the inner porcelain for about halfway up the plug for the purpose of preventing sooting and oiling up. Although early in the war the Oleo factory in France closed down owing to most of the staff having been called up, many of the staff have now been sent back and the works are once again in full swing. We have been told the demand for Oleo plugs now exceeds 6,000 per day.



A few examples of casting work by the Putney Foundry.

The Rotax Motor Accessories Co., Ltd., GREAT EASTERN STREET, LONDON, E.C.

AMONG the very large assortment of fittings and accessories made and supplied by the Rotax Motor Accessories Co. are many which are more applicable to aircraft. These comprise petrol filters, pressure pumps, catches, thimbles, hinges and map case fittings, water joint clips of the bell clip type and a new pattern of narrow section channel brass, which the company are making largely for aircraft engine manufacturers, press buttons, turn buttons, eyelets and washers (including both oval and round patterns). Some years ago foreseeing the great demand which would arise, machinery was put down to supply these special fittings to the Royal Aircraft Factory's requirements. A special department has been formed at the company's Willesden works for the production of streamline wires, complete sets of wires can be supplied for particular types of machines. In spite of considerable additions to the plant in this department, amounting to about 150 per cent., it has been found necessary to institute double shifts to cope with the demand. One feature deserving mention is a landing lighting set designed at the Rotax works, and is based on the principle of the well-known Rotax motor car dynamo lighting equipment.



A Rotax force pump.

The Ruberoid Co., Ltd., 81–83, KNIGHTRIDER STREET, QUEEN VICTORIA STREET, LONDON, E.C.

"RUBEROID" is a roofing material, machine made—by a special process—in the form of sheeting. The principal features of this material are that it is extremely light and pliable, and non-absorbent. It has for its base a fibrous material which has been thoroughly saturated with a secret composition containing no oxidizing ingredients such as tar, asphalte, paper, &c. Some of the advantages of "Ruberoid" are :—it is easily laid and easily repaired, is unaffected by heat or cold, and will not melt, run or drip. It is quite odourless and does not contaminate water—rainwater collected from "Ruberoid" roofs can be used for domestic purposes. When once laid it does not require tarring, painting or annual attention. It is thus very suitable for roofs of hangars, airship sheds, aircraft factories, &c., in which capacities it is now in extensive use.

Rubery, Owen and Co., DARLASTON, SOUTH STAFFS.

WITH an extensive experience in steel work behind them Messrs. Rubery, Owen and Co. are in a position to undertake anything in the way of metal fittings and parts for aircraft, especially in regard to pressed steel and welded tubular work. The accompanying sketches show some interesting samples of steel pressings, such as engine mountings, plane-ribs, &c. They also manufacture a large range of wire strainers, eye-bolts, and such like fittings. Note should be made of the R.A.F. pattern strainer with forked end, shown in the sketch. Other specialities of note are the Rubery-Owen patent release gear for aeroplanes and the Fox wire-bending pliers. The former, in spite of its small size and weight, is exceptionally strong and has proved very successful in practice. The pliers are very simple in action, and bend fairly thick wire with comparative ease, and should be in every aircraft factory.

Rudge-Whitworth, Ltd., COVENTRY.

APART from the production of wheels for which the name of Rudge-Whitworth is known the world over, this firm are now turning out metal parts for aircraft work, especially those for aeroplanes to Government designs, in almost unlimited quantities. The high reputation which has been built up by Rudge-Whitworth production ensures that their work is fully up to standard as regards quality and accuracy and ability to pass any necessary tests.

Skefko Ball Bearing Co., Ltd., LUTON; LONDON OFFICE, 28, VICTORIA STREET, WESTMINSTER, S.W.

EVERYBODY connected with engineering is already well acquainted with the famous Skefko ball bearings, and there is, therefore, no need to go into a detailed description of their design and construction here. The question of reliability is, perhaps, nowhere of such paramount importance as in aeroplane work, and in this respect, as is well known, the Skefko ball bearings have an excellent reputation, possessing with their self-aligning double-row of balls a very high factor of safety.

Speirs, Ltd., 13, BLYTHSWOOD SQUARE, GLASGOW.

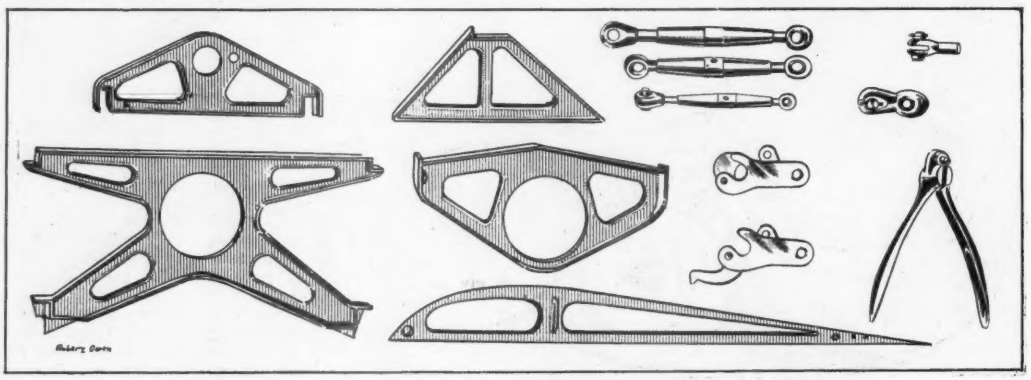
THIS enterprising Glasgow firm of designers and erectors have been remarkably successful in their efforts to produce buildings intended to afford convenience and comfort, and yet being cheaper than ordinary stone or brick buildings. The introduction of the "Speirsesque" system marked a new departure in structural engineering, providing a most satisfactory alternative to ordinary brick buildings, especially suitable for seaplane sheds, hangars, workshops, &c.

Although called iron buildings the "Speirsesque" structures are really composite in character, having a framework of well seasoned timber covered externally with specially manufactured galvanised corrugated steel sheeting.

For many years the firm has been experimenting in their workshops with alternative exterior coverings with materials brought from the Continent, from America, aud even from far Japan, in order to discover one of a solid and substantial yet economical nature, which could be used in place of corrugated iron, to which some people have expressed aversion. As a result of these researches, they devised a combination described as "Plasmentic," which fully meets the high standard of efficiency demanded. The Speirsesque "Plasmentic" cement rough cast construction is absolutely permanent, it is indistinguishable externally from a brick rough-cast building, whilst the cost is considerably less.

The Sperry Gyroscope Co., Ltd., 15, VICTORIA STREET, S.W.

FUNDAMENTALLY the Sperry gyroscopic stabiliser consists of a set of four gyroscopes controlling, *via* a Servo motor, the transverse and longitudinal attitude of the aeroplane. An electric generator driven from the engine furnishes the current that drives the gyroscopes, the speed being kept constant by means of a governing device through which direct drive is obtained when the



A few of the fittings, stampings, &c., produced by Messrs. Rubery, Owen and Co.

14 B.
Twin Points.

Hobson

SPARKING PLUGS

ARE

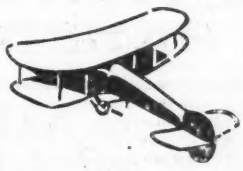
Reliable and Efficient.

This is why they have been chosen by the Admiralty for their aircraft engines.

No. 12 B.
As used on rotary Gnome, Rhone, etc., Engines.

14 I.P.
Single Point.
As used on Stationary Aviation Engines.

No Advance



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AVIATORS! MAKE YOUR PURCHASE AT GAMAGE'S

LEATHER COAT FOR AVIATORS.

The newest pattern, as approved by Officers in the Navy and Army. Large quantities in daily use at the front. In service has proved to be the most useful and practical of all coats for aviation purposes. The length shown in the illustration is the most popular, but it is also procurable in other lengths.

In Black Chrome dressed Leather, lined warm tweed ... ... Price **84/-**
Do., made with Camel Fleece lining ... ... „ **95/-**
In Tan Leather, Chrome dressed, lined camel fleece ... ... „ **£5 10 0**

AVIATORS' BREECHES.

Black Leather Breeches, wool lined ... ... Price **37/6 & 42/-**
Tan Leather Breeches, wool lined ... ... „ **42/- & 63/-**

AVIATORS' CAPS.

The **"Brooklands"** (as illustrated). In black or brown leather, lined fleecy wool, with protective rolls for the ears and tapes to tie under chin. Finest quality ... ... Price **12/6**
The **"Aerocar," the** cap for flying. In black or brown leather, lined with fur. Will keep the wearer warm at the highest altitudes. Wind cannot penetrate ... ... Price **21/-**

FUR CAPS FOR AVIATORS ... Price 12/6 21/- & 25/- each

AVIATION HELMETS.

The Gamage Patent **Non-Concussion Flying Helmet**. Fitted with patent flaps for minimising the sound of the engine ... ... Price **47/6**

AVIATORS' BOOTS.

The **"A.W.G."** High Legs, Quality "A," made of fine quality Brown Waterproof Hide Fronts and Golosh and Sheepskin legs—Caracul fur lined all through, exceedingly warm and comfortable Waterproof Soles ... ... Price **45/-**
Also made in Quality "B," uppers are of Brown Waterproof Hide, lined with thick Caracul and have also an inter-lining of warm material, are impervious to WIND, COLD, RAIN, ICE-WATER, SNOW, etc. ... ... Price **50/-**

Usual height of both these boots is 18½ inches.

When communicating with advertisers, mention of "Flight" will ensure special attention.

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For AEROPLANES requiring protected Rubber Springs.

STRENGTH AND MATERIALS ARE GUARANTEED.
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THE STRONGEST GLUE KNOWN

For the Manufacture of H.M. Aeroplane and Seaplane Propellers, Spars, Ribs, etc., all classes of Glues have been tested, and the one to COME OUT TOP—by a very wide margin—is

"CROID" (Extra Strength) LIQUID GLUE

which also has the great advantage of being
USED COLD AND RESISTING DAMP

THE IMPROVED LIQUID GLUES Co., Ltd.,
Great Hermitage Street, London, E.
CONTRACTORS TO H.M. GOVERNMENT.

engine is going "all out," and indirect drive when the engine is throttled down.

Stalling the aeroplane is made impossible, where this stabiliser is fitted, by an anemometer, which is in reality a double-throw switch controlled by a fan. So long as the air speed of the machine is above the minimum speed at which the particular aeroplane will maintain horizontal flight, the anemometer fan keeps the switch over. If the speed is reduced to a dangerous extent the spring incorporated in the anemometer overcomes the torque of the fan, and the switch is thrown over, setting the elevators in motion until by the ensuing glide the machine has regained sufficient velocity, when the fan overcomes the tension in the spring, and returns the switch to its normal position.

A small universal hand-control lever mounted on the proper control lever actuates the latter *via* the gyroscopes and Servo motor by altering the relationship between the body of the aeroplane and the reference plane. If the pilot wishes to climb he pulls this little lever towards him, and if left in this position the

The Gyroscopic unit (below) and the Servo motor (above) of the Sperry Gyroscopic stabiliser.

machine will continue to ascend at the angle corresponding to this position. Similarly, for banking, the lever is moved to right or left.

In addition to the gyroscopic stabiliser this firm are making a drift indicator, which, as its name implies, shows the path followed by the aeroplane in a cross wind. This indicator, which was described in "FLIGHT" a short time ago, consists of a prismatic monocular telescope through which the path of the aeroplane can be observed. This is fitted with parallel wires, and is connected to the special Sperry compass, manufactured also by this firm, by Bowden cables. By turning a handle until the wires are parallel with the path followed by objects on the ground the lubber line of the compass is shifted to compensate for the drift. A telescope capable of being stabilised at any desired angle relative to the horizontal has been developed by this company for military purposes. In principle this apparatus is similar to the gyroscopic stabiliser.

Sphinx Manufacturing Co., 242, BRADFORD STREET, BIRMINGHAM.

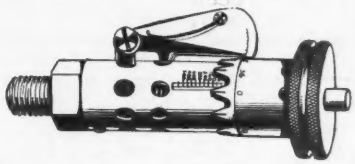
AMONG the many patterns of ignition plugs made by this firm are several which are specially suitable for use on engines, whether rotary or fixed, for aircraft work.

S.R.O. Ball Bearing Co., 115, SOUTHWARK STREET, S.E.

SOME of the advantages claimed for the improved SRO ball bearings supplied by this firm are: The cage is made in two parts of stamped sheet steel assembled by means of stay bolts riveted by a special process. Owing to the peculiar construction of the cage, which stops short of the plane passing through the centres of the balls, there is no friction at the points of greatest surface speed of the balls. Moreover, the grooves or channels in the rings which form the ball races are made of a depth which enables the ball bearings to withstand an axial thrust equal to one-third radial thrust when both thrusts are acting at one and the same time. The SRO ball bearings are made in all sizes and for any special purpose.

George Taylor (Brass Founders), Ltd., BOLTON.

THIS firm's speciality consists of the "Okill" pressure indicator, an instrument which measures the maximum degree of pressure on each working stroke in any particular cylinder of an engine. It also measures the maximum degree of compression attained during each compression stroke. It is an exceedingly simple instrument, as the accompanying illustration will show, and

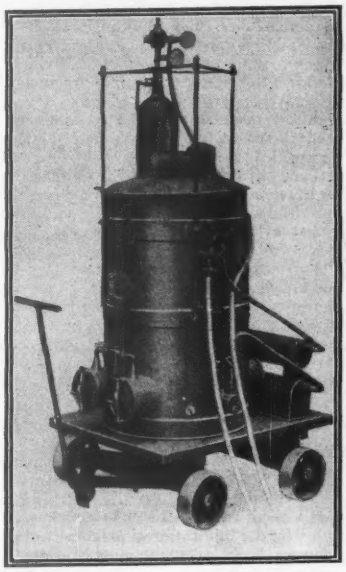


An Okill pressure indicator.

all that is necessary to do when it is desired to test any particular engine cylinder is to screw the indicator either in one of the two sparking plug holes where dual plugs are fitted, or some other convenient hole, so long as the cylinder tested is able to fire as usual. The engine is then run in the ordinary way, and on making certain adjustments to the instrument a pointer on the latter indicates the necessary data. Many of these instruments are in use, and they can be supplied calibrated from 400 lbs. per sq. in. up to 2,000 lbs. per sq. in. Messrs. Taylor also make high-class brass taps, valves, and many other fittings, and can supply parts and fittings to special instructions.

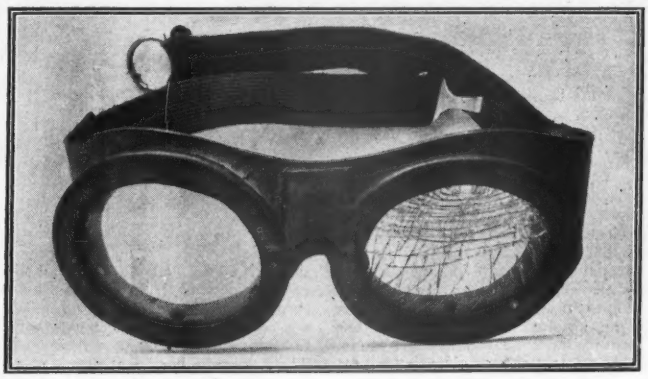
The Thorn and Hoddle Acetylene Co., Ltd., 151, VICTORIA STREET.

TO meet the demand for the oxy-acetylene process of welding in connection with aircraft work Messrs. Thorn and Hoddle supply a variety of oxy-acetylene welding outfits of both the high and low pressure systems. The only difference between the two is that in the high pressure type the fuel gas is drawn from a cylinder of dissolved acetylene, while in the low pressure type it is supplied



An Incanto Oxy-acetylene welding set made by Messrs. Thorn and Hoddle.

from an acetylene generator. Under the trade name "Incanto" the firm supply two styles of low pressure plant, one known as "K," intended for a more or less permanent installation, while pattern R is designed with a view to portability, the generator, &c., being mounted on a truck or trolley. Both styles are made in several sizes, the carbide capacity ranging from 6 lbs. to 75 lbs. Three sizes of high pressure welding plants



A pair of Triplex goggles which have been involved in an aeroplane smash.

are stocked as well as a complete outfit mounted on a trolley.

In addition to welding plants this firm also supplies oxy-acetylene metal-cutting outfits and all necessary accessories for this as well as the welding plants, including high and low pressure blow-pipes, purifying apparatus, oxygen pressure regulators, hydraulic back pressure valves, oxy-acetylene metal cutters, and all welding materials.

The Triplex Safety Glass Co., Ltd., 1, ALBEMARLE STREET, PICCADILLY, LONDON, W.

TRIPLEX Safety Glass is so well known to most of our readers that it needs no introduction here. Suffice it to say that owing to its peculiar construction it possesses remarkable properties inasmuch as it is considerably stronger than ordinary glass, and in the event of an accident it is impossible for it to splinter or fly into fragments. It is built up of two sheets of glass with a sheet of transparent xylonite cemented between them, all three being amalgamated into practically one solid piece by means of enormous hydraulic pressure. No matter how heavy a blow the glass may receive, the non-brittle xylonite holds the glass together so that even if the latter cracks no loose pieces of glass can cause damage. Triplex glass is thus particularly suitable for goggles, windscreens, and map covers, &c. The pair of goggles shown in the accompanying illustration were involved in an aeroplane accident, and it will be seen that although one of the eye-pieces has been severely "strafed" it still remains in place, without any loose fragments.

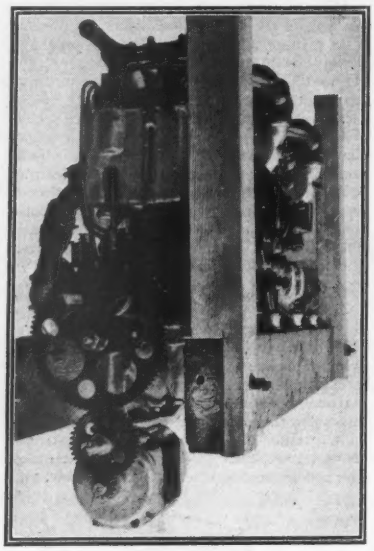
Vacuum Oil Co., Ltd., CAXTON HOUSE, WESTMINSTER, LONDON, S.W.

SOME of the Vacuum Co.'s standard motor car lubricants, viz., Gargoyle Mobiloil "A," Gargoyle Mobiloil "B," Gargoyle Mobiloil "BB," have been found entirely satisfactory for the lubrication of practically every type of aeroplane engine available, with the exception of the valve in piston rotary type, which calls for a lubricant which does not come within the scope of the company's activities; the design of such engines making it impossible to use regular motor oils. For the Green engine Gargoyle Mobiloil "A" is recommended for the 6-cylinder, and Gargoyle Mobiloil "BB" for the 12-cylinder type. Nearly all 8-cylinder V-type water-cooled aviation engines of the Renault, Sunbeam, Wolseley, and similar types give best results on Gargoyle Mobiloil "BB." Some users prefer various mixtures of Mobiloil "A" and Mobiloil "BB" to suit varying conditions. Air-cooled engines of the non-rotary type, which require a heavy-bodied oil, are best lubricated with Gargoyle Mobiloil "B."

These oils are standardised and obtainable throughout the world in various packages, graded from a 40-gallon barrel to a quart can.

C. A. Vandervell and Co., WARPLE WAY, ACTON.

IT is but natural that in view of the success which has been attained by the C.A.V. electric starting and lighting system for cars that the firm should have applied their experience to aircraft. Now that the power of the engines used on aeroplanes is continuing to increase a starting device has become an absolute necessity. With but little modification from the standard model the C.A.V. starter has been giving very good results. In the case of a 90 h.p. Beardmore engine the motor was hung beneath the crankcase, driving the crankshaft through spur-gearing, a large wheel being mounted on the crankshaft, a small wheel on the electric motor and an intermediate idler wheel. With a battery, gears and fittings the outfit weighed less than 84 lbs. The h.p. delivered by the starter was 1·2 and with a specially constructed 12-volt battery, if fully charged and used intermittently, about 30 starts could be made.



C.A.V. starter fitted to a Beardmore aero engine.

Where weight is not a serious matter it is a fairly simple matter to arrange to add to the equipment a small dynamo driven by the engine, thus furnishing the current for charging the battery and also providing the current for a headlight for use when landing in the dark or for illuminating the instrument board.

Vislok, Ltd., 3, ST. BRIDE'S HOUSE, SALISBURY SQUARE, LONDON, E.C.

ATTENTION has previously been drawn in the pages of "FLIGHT" to the undoubted merits of the Vislok safety lock nut, which is unique in its efficiency combined with simplicity. Its growing use in all classes of engineering work is therefore not a source of surprise, and many are the responsible firms and other bodies who are now submitting it to tests with a view to ultimate adoption. The Admiralty has already done so, not only for sea-going ships but also for its airships, so that other aircraft makers who have not already done so should certainly make a point of investigating for themselves the advantages it possesses over the more usual methods.

As regards the nut itself and its action, the accompanying sketches should be all-sufficient. It will be seen that the nut consists of two parts that are hydraulically pressed together so as to be inseparable. On each of the two portions comprising the nut is cut a line, and when these are in register with one another the internal thread is continuous, and the nut can be screwed on to a bolt in the usnal manner. When in position, which may be anywhere on the bolt, the upper part is then given a further partial turn, and the nut is then secure against any automatic slacking off due to vibration. To remove, the lines are brought once more into coincidence, and the nut unscrewed as a whole.

No special tools are needed for its operation, there is no drilling or other special preparation required for the bolt, the threads are undamaged and can be used repeatedly, and there are no loose parts whatever. They are made in practically all sizes in Whitworth and standard threads, and Messrs. Vislok, Ltd., the makers, are prepared to send samples for test to any aeronautical firm making application.

Wadkin and Co., NORTH EVINGTON, LEICESTER.

TO makers of aircraft the name of Messrs. Wadkin & Co. (as specialists in woodworking machinery) is already well known.

The patent strut forming and sandpapering machine has been adopted by many of the leading aircraft manufacturers, and is proving highly successful. With it they are enabled to turn out accurately shaped struts in a time unheard of by the old methods.

Another ingenious product of Messrs. Wadkin & Co. is the propeller shaping machine, which was illustrated in "FLIGHT" of October 22nd, 1915. It is arranged to accurately shape from the laminated state propellers with two, three or four blades, and experiments have proved that the time saved in production should make the machine invaluable in propeller making.

Another machine is a double spindle moulding machine with ball bearings. This has many distinct advantages, the chief ones being the spindles, which are of high quality steel, having the chucks bored and ground to a standard Morse taper. The loose top pieces and French spindles have tangs turned and ground to a corresponding Morse taper, which ensures accuracy in running when the loose spindle or top piece is fitted and secured tightly. Another point is the housings inside the machine frame which enclose the spindles on three sides, leaving an aperture sufficiently wide to allow the passage of the belt. This obviates "choking" the spindles with dust and chips, and affords protection

Sketches showing the Vislok lock-nut complete and sectioned to show its construction.

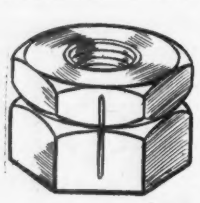


FIG. 1

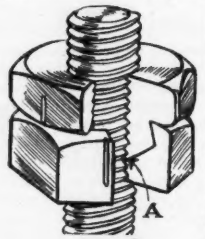


FIG. 2

BURBERRYS

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The Tielocken Burberry (*Patent*)
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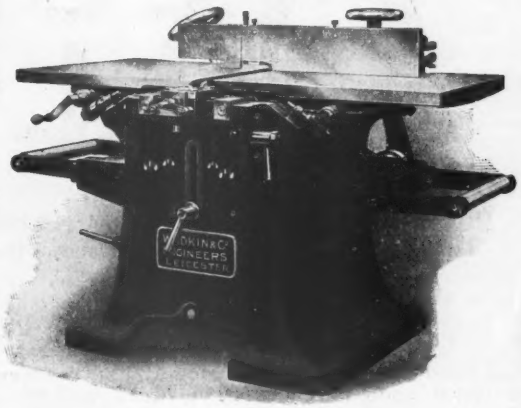

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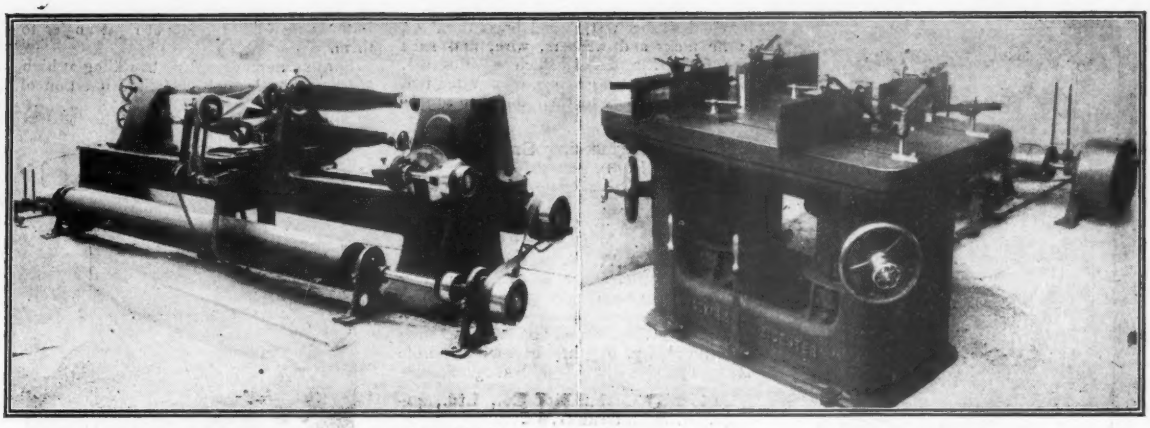


A strut moulding machine and a vertical spindle moulding machine, both made by Wadkin and Co.

to the operator in case of belts breaking. The frame of the machine also is so designed that it supports the worktable at the extreme edge, thus obtaining extra stability and rigidity even when the spindles are running at the highest speeds.

Messrs. Wadkin and Co. also specialise in band saws, planing machines, jig saws, saw benches, thicknessing machines, and other tools used in the production of wooden parts for aircraft. Cutters and small tools have also received attention, and a well-organised and efficient department is in full swing turning these out in large quantities.

C. C. Wakefield and Co., 30 AND 32, CHEAPSIDE, LONDON, E.C.

WAKEFIELD CASTROL "R" heavy or Gnome-Castrol, "the one oil for all engines," is exclusively used and recommended by the Gnome and Le Rhone Engine Co. Used by the British Naval and Military Air Services, and as well as those of the Allied Forces. It is impossible to detail all the many successes in which "Castrol" has played an important part, but it may be recalled that Gnome-Castrol was used by H. M. Brock in his triple victory last year in the London–Manchester–London, and London–Brighton–London, and London–Paris–London races. In our photograph he is seen filling up with Castrol just previous to the start of the last-named event.

W. and G. Walker and Co., EMERY HILL, WESTMINSTER, LONDON, S.W.

IN addition to their standard fan brake dynamometers for measuring the horse-power of petrol engines, Messrs. Walker and Co. also supply a special aviation model,

A Walker fan brake dynamometer for aero engines.

which is shown in the accompanying sketch. The method of measuring the horse-power of an engine with the Walker Dynamometer is very simple and reliable. A pair of plates are adjusted on the arms, which are secured to the engine shaft. The engine is then run and the number of revolutions taken, and on referring to a specially prepared chart—supplied with the dynamometer—the h.p. is read from the curve corresponding to the particular radius at which the plates are adjusted. The arms of the aero model are made of ash, and are mounted on a boss which fits on the engine shaft in the same manner that a propeller or tractor screw does.

The Whitehead Aircraft Co., Ltd., OLD DRILL HALL, TOWNSHEND ROAD, RICHMOND, SURREY.

ALTHOUGH being themselves busily engaged on the construction of aeroplanes, this firm, by good organisation of their shops, and by making the best possible use of their works, have been able to produce not only the fittings to meet their own requirements, but have facilities for supplying wiring plates and blanks made to R.A.F. specifications at short notice. Among other accessories the Whitehead Aircraft Co. make a speciality of turnbuckles, of which they are in a position to give quick delivery. Manufacturers who experience any difficulty in obtaining any of these fittings would do well to communicate with this firm.

Whitely Exerciser, Ltd., 35, SOUTHWARK BRIDGE ROAD, S.E.

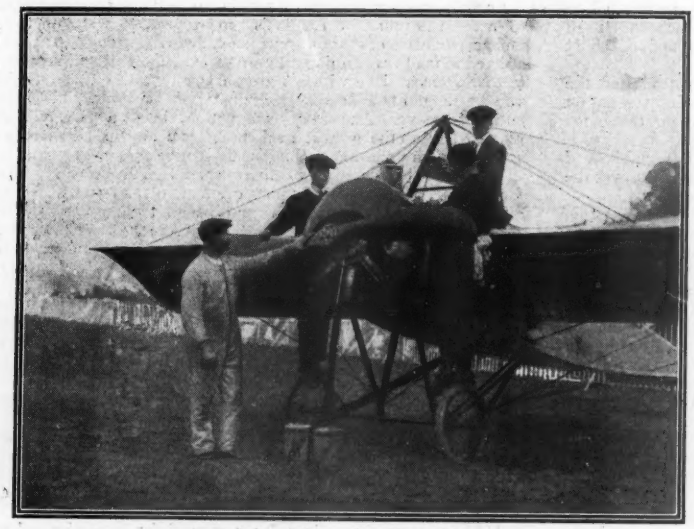
WITH their long experience in connection with braided rubber cord this firm are making a speciality of supplying British-made

A Flexten shock-absorber made by the Whitely Exerciser, Ltd.

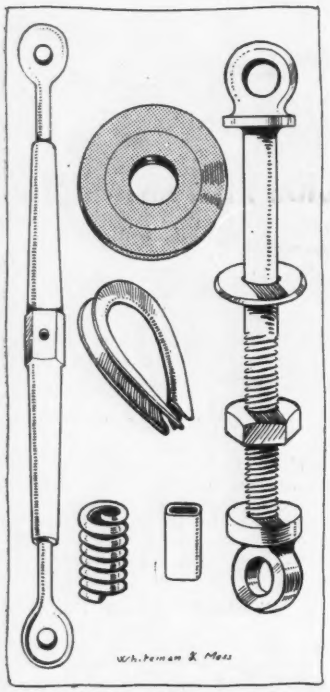
rubber springs for shock absorbers for aeroplane work. Their Flexten shock absorbers are supplied in various styles complete with the necessary fittings, but being actual manufacturers they are in a position to comply with special designs for any strength and duty.

Whiteman and Moss, Ltd., 15, BATEMAN STREET, DEAN STREET, LONDON, W.

ONE of the first firms in this country to lay themselves out for the supply of general parts, small fittings, &c., for aircraft. Messrs. Whiteman and Moss in normal times carry a large stock of parts that are in constant demand. At the present moment, however, under the exceptional circumstances that now prevail, they naturally find it somewhat difficult to keep up with the orders for certain items. In some cases where early delivery could not be promised, orders have been refused, the policy of the firm being



Brock filling up with Castrol previous to starting in the London–Paris–London Race.



Some specialities of Messrs. Whiteman and Moss.

only to take orders which can be executed in proper time. Just now, however, they have a good stock of wire ferrules, copper ferrules, bevelled washers, steel and brass thimbles, fabric tacks and washers, wire, and such like fittings, some of which we illustrate. Enquiries will be given prompt attention, and notification as to their ability to supply will be given.

Yorkshire Engineering Supplies, Ltd., HUNSLET ROAD, LEEDS,

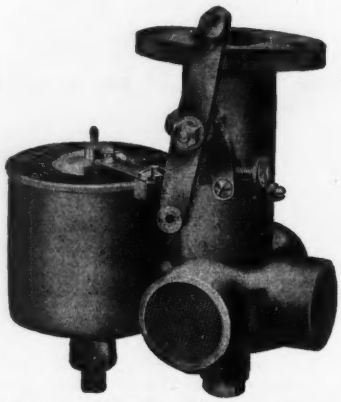
ARE the sole makers and sellers of the well-known Y.E.S. phosphor bronze specialities, that are cast by the "Eatonia" water-cooled process. Mention may be made of a few of these Y.E.S. specialities: The "Aero" bronze, which is used extensively on R.A.F. engines; the "15" bronze, which is specially suitable for motor chassis bearings; the "Worm Wheel" bronze, possessing great durability. All these have a high tensile strength, and are absolutely homogeneous.

The Zenith Carburettor Co., Ltd., 40-42, NEWMAN STREET, W.

BEING so well known the British-made Zenith carburetter needs little description here. Suffice it to recall its chief characteristic, the two petrol jets disposed concentrically, one being the compensating jet which automatically adjusts the mixture to the piston speed, thus avoiding too rich a mixture at high engine speeds and too weak a mixture at low engine speeds.

A variety of sizes are made enabling the firm to meet the requirements of makers of aero engines of varying types, ranging from the lowest powered rotary or radial to the highest powered water cooled Vee motor. Apart from the question of sizes, two distinct styles of carburetters are manufactured, a vertical and a horizontal type, the principle of both being the same in both cases, the only difference being in their general arrangement; in the vertical type the intake pipe is parallel to and concentric with the jets, while in the horizontal type it is at right angles to them.

For use on an aeroplane travelling at high speeds and great altitudes, the question of



One of the latest pattern Zenith carburettors.

heating the air supplied to the carburettor is one of great importance, and in this respect the Zenith lends itself readily to heating either by means of water or hot air. Which of the two forms of heating to employ depends, of course, on the type of engine used.

In France the Zenith carburettor is now fitted as standard to a great number of French aero engines, while in this country the number used by leading manufacturers is rapidly increasing.

CLOTHING AND AVIATION

I LIKE to think that the Germans are responsible for most of our troubles; I could even, by a slight stretch, imagine that it is their fault that I have to wear clothes.

In the earliest days when the greater part of the North Sea seems to have been a marshy plain over which the Thames meandered to join the lower course of the greater Rhine, which discharged itself into the distant Arctic Ocean, neolithic man knew nothing about weaving.

Though still a mighty hunter and fisher, he had domesticated the dog, the ox, the sheep, and the hog, and was not entirely reliant on the proceeds of the chase for his existence, but he had not descended to weaving.

Then in the Bronze Age the brachycephalour, or round-headed man (surely Embryogeny Germanic), came from somewhere over the marsh, superseded neolithic man, and introduced weaving.

Many years later, a tribe of Germans from the south-east of Schleswick came over and settled in Britain, and gave it the name of England, I approve of England; I am proud to be an Englishman, but I could find it in me to wish I did not have to thank Germany for the name. I could easily lay some small blame on those early neolithic men, and later, on those other tribes who were for ever scrapping for the possession of this land, that they did not sweep the whole lot of the roundheads into the sea; I might not then have had to wear clothing other than the skins of animals.

Did I have to go out and shoot a new overcoat, or net a pair of lower garments, I think it would quite fit in with my idea of things as I should like them, but to go to a shop and choose, and try on, does not seem to me to be the business of men.

Had I no fear of being mistaken for a wealthy man, I would perambulate my way through my allotted span in clothing that should worry everybody except myself.

And thou, O Aviator, being of my gender, art of my way of thinking. Thou soarest in the high air in thy summer raiment when the cold of our winter season is upon us, and because thou hatest shopping thou wrappest thyself about beneath thine outer garment with the large sheets of a daily paper which doeth everything for aviation, yea, even to keeping its disciples warm.

Withal, you require winter clothing, Could it be spread out in splendid profusion at your aerodrome, and you had nothing to do but choose and pay, you would refit in no hesitating manner. But to make the round of London's show-rooms, to walk up to an immaculate being of your own sex (generally in the wrong department) arrayed in faultless morning attire, and explain that you require a leather overcoat lined with sheep-skin woolly side out, arouses in you a feeling of humbleness which his "Step this way, sir" cannot entirely remove. And in your agitation, being a man, you are pleased to grab the nearest available article to your requirements, and—wish with me that clothing could still be shot or speared.

You are to be spared this embarrassment. The order has gone forth that I, who dislike shopping even more than you, shall visit all the showrooms, interview on your behalf the heads of departments, inspect and report, and generally clear the way for you so that you have but to proceed to the Aviation Department of the stores of your choice, ask for Mr. ——, and he will greet you as an old friend.

I hope it is now perfectly clear to you that I am going to talk about clothing, and not geography. I am going round the shops on your behalf, but I see no reason why you should not come with me—in these pages; so let us start on our tour, and get down to the realities of this twentieth century.

In my quest on behalf of the aviatic world I have made up my mind to note only what I consider a real boon, and with that thought in my mind, naturally **Harrod's** suggests itself for a first visit. The entrance we require is at the side, in the eastward end of the huge building, and the aviation clothing department is on the ground floor. Asking for Mr. Gillins, we are instantly in touch with what we require.

Here are *some* of the lines I recommend for inspection. Long coats, short coats, three-quarter coats—how shall I ever describe them? Sheepskin jackets, lambswool waistcoats, leather suits,

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overalls, underalls, gloves, boots, caps—oh dear! A beautiful aviator's three-quarter coat (the adjective governs the coat) in black or tan sheepskin, chrome dressed, and really soft. All-round belt, large side pockets and diagonal map pocket; double breasted, with extra wide overlap fronts, and double collar to turn up, with cross piece to button over the throat. Lined with dark grey fleece, it makes a really serviceable coat. The same in half length, at less money but no reduction in quality.

Complete leather trouser suits in black or tan, and a Naval coat, also in both colours, with the usual side pockets and large map pocket.

Gloves of every description, lined with every conceivable material calculated to keep the hands warm. One, in particular, I noticed, with the underside of the finger tips left unlined in order to facilitate the feeling of switches. Another good line is a gauntlet glove, lined with fleece, with waterproof canvas backs and leather fronts, and strap fastening.

Flying caps of every description, lined with fur, or fleece, or unlined. Helmets, wool under-caps. Long boots, short boots, boots lined and boots unlined; everything one could possibly want in the way of equipment. There! I don't think that is so bad for a start.

In these strenuous times it is proper to economise in fares, and it being a lovely day, we will walk through St. James' Park to Piccadilly Circus, where, on the corner, but numbered 30, Regent Street, are the **General Aeronautical Company**, known the world over as the "G.A.C." Obtainable here is everything connected with aviation, from an engine to a pair of goggles. In clothing, they specialise in Kapok, that wonderfully light, waterproof, warm, vegetable wool, which in addition to other qualities, is buoyant in water, thus acting as a life-saving jacket should mishap befall an aviator when over water. The material is used in a number of forms, principally in the shape of undercoats and waistcoats. In the waistcoat form, they may be had made up in the ordinary way, to button down the front, or simply with straps over the shoulders, looking very much after the style of the cork jackets worn by lifeboat men.

In jacket form, it is made not quite so thick, and with sleeves, the Kapok in this case being sandwiched between flannel, and made more with the idea of warmth than with life saving, although even with the lesser amount of Kapok, the buoyancy is remarkable, and quite capable of keeping the wearer afloat in smooth water.

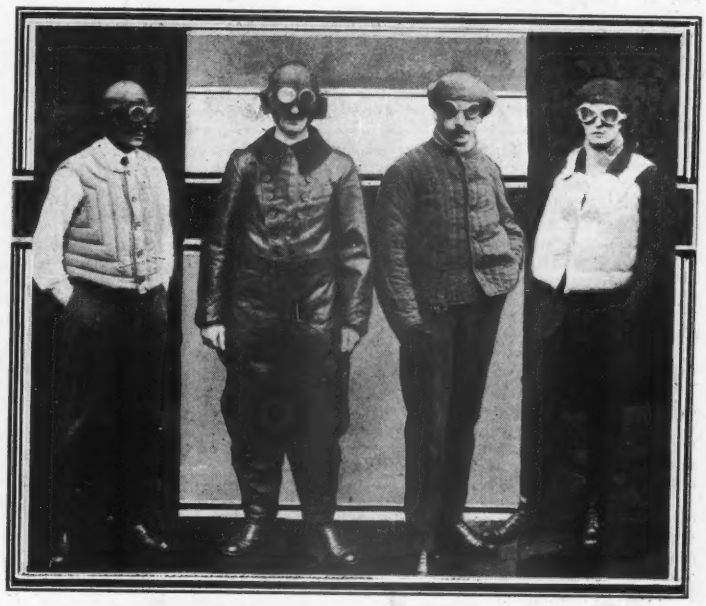
A one-piece suit in black, chrome dressed leather, is also a speciality, it being also Kapok lined, although, of course, to a lesser extent than the life-vests primarily intended for life saving. Nevertheless it should be very buoyant, and it certainly is beautifully made. It has an all-round belt, and the leg is fitted with buttons for some distance upwards from the ankle, so that the wind is prevented from entering. Although not strictly an article of clothing, as Kapok is again used, mention may be made of their sleeping bag. In this case, it is used purely on account of its warmth. The bag is in waterproof sheeting, and the lining makes a very snug article in which to pass the night when compelled to rest on the earth. With sleeping bags in general, the difficulty is to get into them and out of them, especially the former.

This particular bag has one of the neatest arrangements possible to obviate having to get in at the top, feet first. Some bags button over, but there one has to sit up and start the buttoning process at the bottom. In the bag in question, there is fitted a very fascinating arrangement of a kind of hook-and-eye chain on each side. The fastening is accomplished by simply pulling a loop fastened to a little fastening disc or wheel, which runs along and fastens the whole thing up. Just how it is done I cannot say, but it is a most ingenious device. To emerge in the morning, all one has to do is to take hold of the two sides of the bag as though trying to tear it apart when the little disc retreats to the bottom, opening the bag on its journey.

And so to **Burberry's** in the Haymarket. To expatiate on Burberry goods is about on a par with trying to paint the sky blue, but as the lines there dealt in are entirely Burberry, we ask for Mr. Doman, and proceed to investigate their unique examples of high-class tailoring.

The "Tielocken" long flying coat is just the very thing for the purpose. The material is absolutely weather-proof, and it has an exceedingly great overlap front, extending right to the bottom, so that the legs cannot get wet through the blowing up of the coat. To further prevent this happening, there are straps through which one can pass the legs, which yet do not interfere with walking. It is made in two colours, khaki for military wear, and blue for naval wear, and being of material in the place of the usual leather, it is almost impossible to tell the coats from those cut from ordinary cloth. The belt is of the all-round type, but, as unusual, it adjusts both back and front. Side pockets are provided, and the collar can be used in three positions. A feature of this coat is that there are no buttons—all fixing being accomplished by easily-adjusted straps and dome clips.

"Garbadine" is a material used in many ways, including the manufacture of complete flying suits, after the style of the well-known leather suits, but here with distinctive features with regard



Ideas for safety and comfort at the G.A.C.

Aviators' outfits seen at Burberry's.

to cut and finish. The material is weather-proof, as distinct from water-proof only. It will throw off any quantity of rain, and yet give ventilation to the body, which it also keeps warm at low temperatures. Sir Ernest Shackleton used a suit of this material on his Antarctic Expedition, and expressed, in a letter, his admiration of its ability to keep out the wind and cold in a blizzard. As all the world knows, military coats and uniforms, as also naval, may here be obtained in the firm's weather-proof materials—these including that of the Royal Flying Corps.

In addition there are fur-lined under jackets with sleeves. Long under coats lined with camel fleece. Flying caps lined with fleece or garbadine, and warm clothing of every description.

One good line in gloves is a pair made of horseskin. To look at they appear to be brown suede, but their speciality is that they always remain soft. When wet they do not get "sodgy," and when they dry they dry soft and flexible, so unlike the usual leather glove, which will generally dry hard and stiff. They are, I need scarcely say, lined throughout with fleece.

Much more as there is here to inspect, we must away to our next call at **Gamage's**, to be further mystified with the thought and care that has been put into aviation clothing and equipment on the flyer's behalf. Here, following our custom of getting on the spot quickly, we ask for Mr. Kent of the aviation department, whom and which we find on the first floor.

To say that Messrs. Gamage have entered into the equipment of aviators with the same thoroughness that they enter into everything which they undertake, is to say here everything that could possibly be wanted will be found. As our mission is more especially concerned with clothing, it will be but necessary to say that all accessories appertaining to flying are stocked in great variety. Goggles, wrist watches, map cases, note books, pocket books, sketch blocks, and the like, too numerous to mention. Leggings and boots in all conceivable forms, and in rubber or leather, lined or unlined. But to our clothing.

Here again we have the favourite black or tan leather flying coat, fleece-lined as usual, and in three lengths. This particular form of coat is in such universal demand among aviators that it is not surprising that in nearly all outfitters' stock it is one of their leading lines. Even so, there is always some slight difference in the cut, or the shape, in the method of fastening, or in the arrangement of pockets, making inspection well worth while.

An article worthy of attention, is a sleeved waistcoat, made of goat and rabbit skin, with the fur outside, and lined with fleece. Worn under an unlined leather coat, generally used in summer flying, it is ideal, though there is no reason whatever why it should not also be worn under a winter coat, and thus secure the extra warmth.

Not always are under-jackets supplied with a storm-flap, this function being left to the outer coat, but here is one in leather which is so fitted, and one advantage is, that when flying in ordinary weather, and there is no necessity to turn up the huge collar of the greatcoat, this storm flap prevents the wind from penetrating to the chest, and that without the inconvenience of the other.

A great variety of under-jackets and waistcoats, in all materials from leather to camel fleece, makes one somewhat undecided in judging just which to choose, but with some little idea of our own as to our requirements, coupled with the experience of Mr. Kent, the matter becomes simplified.

Here, again, is a complete aviation costume in black or tan leather, called the "Blériot." It is made all in one piece, is windproof, and lined all through with camel fleece. One advantage is that there are no ends to flap about and get in the way.

Those who do not happen to fancy the long leather coat as described above, will find this suit he very thing.

The Fur Cuirass, as worn by our troops at the front, is here obtainable, made in rabbit fur or goat skin.

Flying caps and helmets of every description. The pull-on, made of imitation astrachan and leather, with ear-flaps to tie under the chin. The storm cap, which is a black waterproof hood, pulled on over the head, leaving an opening in front to look through, but coming well down on to the shoulder in the form of a sleeping cap. The same thing may be had in rubber if required. The hard helmet is not so much worn now as formerly, but for those who prefer them they are here in almost every make.

Gloves for aviators are, of course, in great variety. There are the long gauntlet glove in leather, black or tan, and lined in fleece or fur, with straps to fasten across the wrist. Also the shorter glove of the same make, but coming just above the coat sleeve instead of well up the arm.

Gamage's clothing for air work.

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As the inner-man, in addition to time, is pressing, and as there is an excellent restaurant in the building, we cannot do better than have lunch here before passing on to **Selfridge's**, our next place of call.

Again we are brought almost to a state of irresolution in our choice owing to the munificence of the display. We are fortunate, however, that in Mr. Wybrow we have an expert who has been connected with flying and motoring from the early days, and so, should it be a question of this, or of that, his experience in the knowledge of what we require cannot help but be of great assistance in forming our decision.

In black and in tan, of all usual lengths, are again to be seen those fleece-lined leather overcoats. Can there be a distinction without a difference? Under-jackets in tan leather, with sleeves, are remarkably warm, and these are fitted with wind-cuffs. In suede they may be obtained, should you not fancy leather of the faced variety, or again, in a leather which is washable, and all are lined with lambswool.

Here is a jacket, quite a short affair, coming as it does but to the waist, much after the style of an Eton jacket. It is in black leather, has sleeves, and is double-breasted. It is lined with fleece, and is just the thing to wear under an ordinary overcoat when aerodrome flying, which is generally for short periods.

Should leather be not your fancy, or if you have a leather great-coat but require something underneath, here is an under-jacket of fleece only, quite a little blanket jacket, with side pockets, which looks remarkably comfortable, and is of small price. Failing the want of a jacket, you may be fitted with a suede leather waistcoat.

A canvas overcoat is a novelty to me, yet there is one here—a long coat, absolutely waterproof, I am told, and lined with sheep-skin; not quite so soft and flexible as the leather coats, but very efficient, and the price is very moderate.

And now to **Dunhill's**, who have opened special show rooms for aviation and service clothing and equipments at 2, Conduit Street, Regent Street. The selection of clothing here is well up to their usual standard in quality and assortment. The leather flying coat in various lengths is of course in evidence, and in addition they have some novelties of their own. One of these is a Japanese paper under-jacket. The warmth of paper as an under-garment is well known, and in this article it is utilised in the best possible manner, by making it into a jacket which is exceedingly well made, very strong, and not easily torn. The price is one which admits of replacement at frequent periods, though of course it is doubtful whether the substantial leather under-jacket be not the better economy in the long run. In leather, they have the usua waistcoats and jackets, and in addition, those in sheepskin and fur. The Flanders Coat is one eminently suitable for soldiers' wear, who in addition to using it when flying, will want to walk about in it. It reaches just to the knees, and is made in softest tan or khaki chrome dressed leather, and has a detachable pure fleece lining. The usual pockets are provided, and it has the favourite all-round belt.

In gloves, it may be taken that Messrs. Dunhill are experts in knowing what to provide, owing to their vast experience in the wants of motorists. At Conduit Street the variety is almost unlimited, and every aviator may be sure of finding a pair to suit him.

Flying caps also are in profusion, as are also boots, leggings, and everything necessary to the flying-man.

With an industry making such gigantic strides as aviation, and whose workers are increasing so rapidly in numbers, it is not surprising that business houses who had not hitherto catered expressly for the aviation world, are rapidly falling into line, and adding a special department for this purpose. One of these, who may not at the moment be very well known amongst aviators, is Messrs. **Robinson and Cleaver** of Regent Street.

The stock now carried in the department is a good one, and here may be found practically all that is necessary in flying kit. In addition, they lay themselves out to supply service uniforms and equipment for officers, including camp necessaries. For aviation, there is the usual assortment of flying coats and jackets. Under-vests, under-jackets, complete leather suits and what not. A speciality is a set of oilskin overalls which are waterproof, and at the price, a good substitute for the more expensive leather suits. A visit here by those interested will be time well spent.

Well, I have come to the end of our little chat on clothing, and I trust I have been able to make it interesting reading, and also that I may have been able to smooth the way a little to those who are thinking of re-fitting.

I have been able by the use of a few sketches and photographs to illustrate some of the things seen, although they convey but a poor idea of the real articles. In conclusion, I found during my round, that the old-fashioned servile, ambiguous bowing and scraping to customers used by the old-time salesman, together with the stupid mock-humble counter-language they used to use, has entirely disappeared. Those in charge, many of whom I have been able to mention by name, are straightforward business men, whose business is to see that you get exactly what you want, and not what they would like to sell. They will talk things over with you as with an old friend, and advise you to the best of their ability. It is an experience worth cultivating to have an interview with these experts in their particular sphere.

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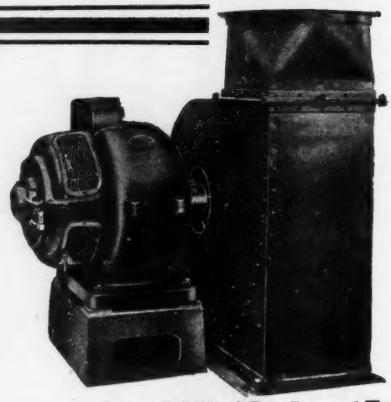

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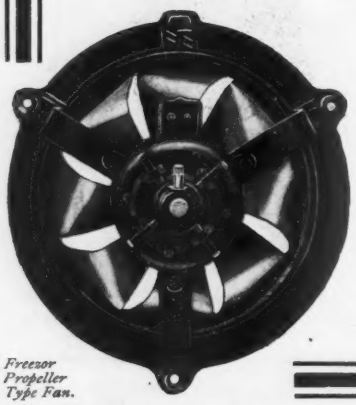

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REG'D TRADE MARK

It is to a greater or lesser extent expected of me that I write in this page of matters aviatic. Yet as a dreamer, as one whose inclination to write interestingly is stronger than his ability to write instructively, I am graciously allowed a certain licence. To-day I cannot write of aviation. I have written and talked and worked for aviation the whole week, and on this day I cannot.

And you, reader, you also have worked all the week for aviation, and you have read, or will read the other pages of this number where is set down aviatic knowledge of the best obtainable. Can I hope that you will be interested in my page also, though I speak not of aviation do I but try to embody a little thought into it?

There are before me on the wall as I write, two picture frames containing photographs. In the one are three views taken in Ceylon some years ago, the other contains the portrait of a dear friend of mine, these many years gone to his rest. Those pictures have been on my wall a long time, yet only to-day have they, dissimilar as they are, started a train of thought wherein they appear to merge together and point a moral. I shall describe the three views.

The first shows a beached, catamaran surf-boat; three natives are standing in it, and one by the side. Their clothing consists of a sun-hat and a piece of patterned cotton cloth hanging from the waist. They are fine, healthy-looking men, evidently well fed to grow to such statue. They have their boat, and the sea, and the sky, and are happy; they are all laughing. I do not suppose the Savoy Hotel if placed on their native beach would have any great attraction for them beyond curiosity.

The next view was taken in Colombo. It shows a very fine, wide street, in the centre of which is an avenue of thick trees cutting out the fierce glare of the sun, which penetrates to form patches of light the ground over. Natives of all ages, and both sexes are walking about clothed in picturesque array, and on the right are a number of jinrikisha awaiting passengers. It is a peaceful scene, yet the stone-built, European-looking houses seem out of place, the waiting rikisha suggest a certain indolence, and down the middle of the road, pushing their horrid arms among the green leaves, are a row of electric-tram standards, with, in the distance, a tramcar; horrible symbol of the coming of commercial men, men who will work themselves, and make the happy native leave his little boat, and work also, to uphold supposedly necessary adjuncts to happiness.

The third view is a view of Colombo Harbour, taken from the top of the lighthouse. Anchored well out, in two rows, stem to stern, are eight huge battle-ships, five British and three German, emblems of "civilisation." Need I give your thoughts a lead regarding this picture after the other two?

The picture of my old friend shows him as a man getting on in years. It was taken in the "den" in which I have passed so many happy hours in his company. As a compliment to myself, I was allowed to take the only photograph of him ever taken, and that, only on condition that I printed but one copy for myself, and then destroyed the negative—he did not want, and did not have, a copy.

His was a character the like of which I wish we had more amongst us. He was reputed to be immensely rich, and a miser. He was *not* immensely rich, although his income ran into three figures every week, and he was not a miser. What, then, became of his money? *He gave it all away in charity*, including his post-mortem bequest of five thousand pounds, less expenses; gave it away, almost always anonymously, and when not that, secretly. You are interested in him? I shall tell you of him.

In those days I played a little on the violin—he played magnificently. He possessed a genuine Strad, surely sufficient reason to bring us together. He was a bachelor, although by no means opposed to wedded life—his secret his mine. He lived alone in the West-end of London, with but one aged female servant who came in daily after his departure to the City, and who had strict instructions to be gone before he returned in the evening. I saw her but once during all the years of our friendship; I think he, himself, saw her but a few times a year, yet I doubt not she had an easy job and a good master.

A crank? Not by any means. He was the most lovable man I ever met, and as happy as could be—happy with his music and his books and his pictures. He had but one room, apart from his small sleeping-room, and it was always in a condition that appealed to me as to him, the whole place was littered in glorious untidiness with books and prints and paintings and sheet-music and drawings and writings. Cigars and wines were always ready to be brought forward, though a whole heap of "this rubbish," as he called his miscellanea, had to be roughly thrown aside, or on the floor, to make room for the tray. He had other male friends beside myself, and we used to play whist or talk books, and blow clouds to the ceiling.

When I was alone with him, he would sometimes get out his Strad and make cold water run up and down my back, or emerge scalding hot from my eyes. He dressed soberly, lived soberly, and was as happy without high-faluting things as those natives of Ceylon with their boat.

Last week my business took me the round of the shops in the West-end. Those catering for men were showing sober goods, serviceable goods, mostly in drabs and khaki. The ladies' departments were making a brave endeavour to pretend we were not at war. I saw a lady dressed in furs that must have cost hundreds of pounds. She was loaded up with purchases, and she was looking into a shop window to see what more she could buy, she who was already by ostentatious display far into vulgarity.

Not for the betterment or their own happiness did those natives of Ceylon leave their catamaran, to go and build tramways.

It is the rabid disposition to seize more than is necessary to sustain human life in happiness and comfort, that caused those ships of war to lie off Colombo Harbour. My old friend was an object lesson—would to God the whole world could have known him.

EDDIES

IT seems that I was right in my surmise last week with regard to the identity of the pilot who paid the "lightning" visit to Hendon the Saturday before last. I now have it on good authority that the machine was a Vickers scout and that the man at the stick was Mr. Harold Barnwell, the well-known pilot and designer. It did not really require a Sherlock Holmes' power of deduction to arrive at this conclusion, for when you come to think of it there are not such a stupendous lot of machines knocking about that are capable of the performances put up by the Vickers "streak." And as for the pilot, well, it is not every holder of a *Brevet* that is keen on flying nor yet landing such a 'bus, let alone looping on it and at such low elevations. So there you are, a simple process of elimination does the trick. And the 'bus itself is nothing to look at—at a distance, as you may judge by the couple of "snaps" which appear in another page this week.

"Flight" Copyright.

One of the German trophies of war that have been on view for the past week at the Horse Guards' Parade. An Albatros biplane (Mercedes engine) which has been rather severely "strafed" by our boys at the front.

× × ×

Talking about Mr. Barnwell and his wonderful loops on his equally wonderful machine calls to mind an occasion, away back in the dark ages of aviation when looping had not even been thought of, much less attempted, I was paying one of my usual visits to the aerodrome and as one of the Vickers school 'buses was just being brought out Mr. Barnwell invited me to come for a "joy ride." I was unaware of the fact that he had been practising some horrible side-slipping spiral *vol plané*, and in my innocence I gladly accepted the invitation. When we had reached a height of a few hundred feet Barnwell switched off his engine and began the glide without, it seemed to me, getting the nose of the machine down. The turns became shorter and shorter and the bank steeper and steeper, until I felt perfectly certain that something had gone amiss. While clutching firmly at the nearest strut I looked around to see if I could discover any reason for the 'bus's unseemly behaviour, but the planes, *ailerons* and rudders were all there, as far as I could make out under the bewildering conditions of having the wings and elevators vertical and the rudders horizontal. I happened to look down, or rather across, as we were by then on the same horizontal level, at the pilot, and was somewhat reassured to find him grinning. I have since always been glad that he didn't have a camera! However, just as it looked as if we were going to try Helen's stunt of landing on a wing tip, the machine flattened out and we landed without the engine—not literally, of course. Since then I have had a great admiration—not to say respectful awe—for Barnwell's piloting, mingled with a little nervousness when going up with him; not that you do not feel perfectly safe with him, but you never quite know what new stunt he is going to put up against you.

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In connection with the challenge issued by Messrs. Mann and Grimmer, backing the "Mann" biplane against any two-seater "pusher" for speed over a 30-miles course (round pylons excepted), we have received from Mr. Grimmer the following: "I should like to except one machine, and one only, from my recent challenge to pushers. Mr. de Havilland has recently demonstrated to me that the new de Havilland is faster than the 'Mann.' It is only fair to say, however, that this machine was not in existence when the challenge was made. Please note that my claim that the 'Mann' is the fastest pusher in the world is henceforward with-

"Flight" Copyright.

ANOTHER "PRISONER OF WAR."—A German Albatros scout which was forced to descend, but which appears to have almost entirely escaped damage by our shells.

drawn. It is no disgrace to be beaten by the new de Havilland, which I consider to be the best all-round aeroplane that I have ever seen."

Comment would be superfluous.

× × ×

With this cold weather coming along our service aviators are beginning to feel the want of warm clothing—no, this is *not* an advertisement for somebody's knitted caps—and several pilots are reported to have invented some highly original forms of head gear. One of them, I am told, has had a nice wolf skin made up in the form of a cap, similar in a way to those worn by Canadian trappers. The head with its fangs comes over the forehead of the wearer, giving him a somewhat ferocious appearance. I have it on good authority, however, that there is no foundation for the rumour that his commanding officer has absolutely forbidden him to wear the cap when on active service, on the ground that if he were brought down by the Germans, the famous Bureau, whose name also is reminiscent of the *genus canis*, would immediately spread the report that the treacherous English—Gott strafe them—were now training wild animals for air service.

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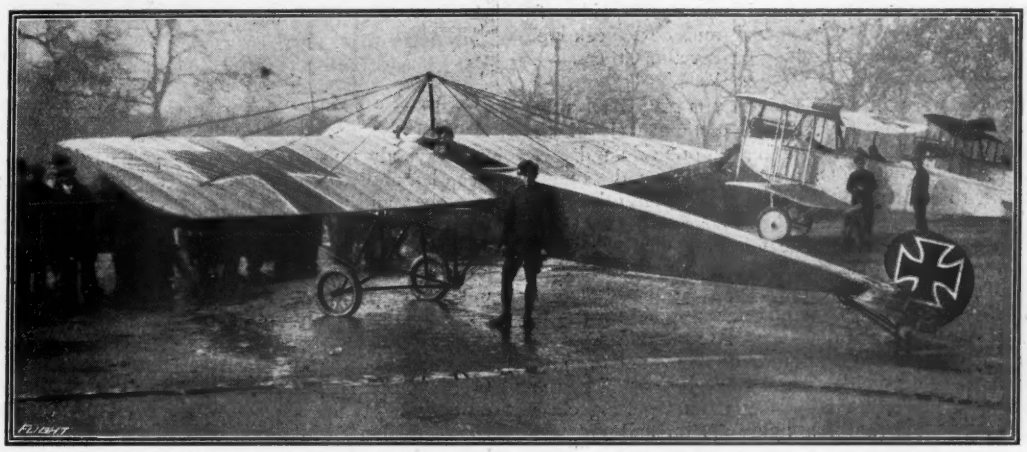
I have spent a highly interesting half-hour examining the three German aeroplane trophies which are on view on the Horse Guards Parade. Two of them, the Fokker monoplane and the Albatros scout, do not seem to have suffered very much from our anti-aircraft guns, whilst the third—another Albatros—bears eloquent testimony to the efficacy of our gunners out at the front. Its tanks, radiators, and *fuselage* are peppered with shots and shrapnel, and from the position of some of the holes it would seem that both the occupants must have had a sultry time of it. Whether or not they were wounded I am not in a position to say.



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"FETCHED DOWN."—A Fokker monoplane, of which the Germans employed a considerable number during the earlier part of the war. These machines are now mostly used for school work.

The Fokker monoplane, which, by the way, looks a little the worse for wear, has a strong suggestion of the Morane about it. The plan form of the wings is similar although the section is totally different, and the body is of the Morane type with the exception that it appears to be considerably longer. The undercarriage also is entirely different from that of the famous French machine, the stub axles being hinged to a central longitudinal tube, whilst the shock absorbers are situated inside the body, somewhat after the style of the French R.E.P.

MEASURING THE WIND AT A GERMAN BASE.—A small test balloon is sent up to give an indication of the force and direction of the wind.

monoplanes. The rotary engine, which one at first takes to be an 80 h.p. Gnome, proves on closer examination to be the German version of the Gnome—the Oberursel—and does not look anything like so well made as the original.

× × ×

The smaller Albatros is very similar to the machine that was demonstrated over here in the summer of 1914, shortly before the outbreak of war, by Herr Thelen. It has a shorter span, however, and only two pairs of interplane struts on each side in place of the three pairs with which Thelen's machine was fitted. The engines on this as well as on the other Albatros are the well-known Mercedes motors, and also as regards the general arrangement are these two machines very much alike. In the larger one the pilot sits in front and the gunner in the rear cockpit, where is still seen the lug that served as support for the gun. The accompanying photographs will give a general idea of the appearance of the "prisoners," and next week we hope to be able to say something further about them.

× × ×

Quite a realistic little game of war was played recently off New London, Conn., U.S.A., the participants in which were two of the U.S. submarines on one side and Mr. Vincent Astor's Burgess-Dunne aeroyacht on the other. According to our New York contemporary, *Aerial Age*, a member of the crew of one of the submarines—the D-4—describes the encounter in the following manner: "We knew in my D boat that Mr. Astor was running a mighty nifty craft, a new sort of catamaran, a hydro-aeroplane if you like to call it that, or a power boat good for thirty-five knots an hour, and that he and Capt. Stirling were under special orders to catch us if they could and drop us, by ramming or by shell, down to Davy Jones—all by the theory of the game, just surprising us and getting close enough to shoot or ram if a fight was on and not war play.

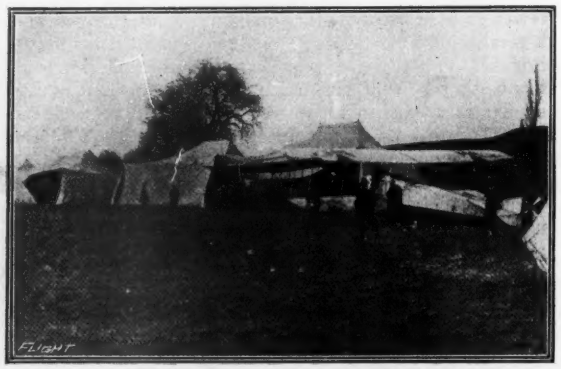
"The D-4 (and she's some boat) snooped around, taking a look through the ceiling now and then, but finally we had to rise to the surface to charge the batteries. We hadn't any more than come up to daylight when the navigating officer sighted Mr. Astor's submarine chaser. It was a long way off, but it was coming faster than a wild duck, with water shooting up stiff and white as the bow cut ahead. We tried to duck, you bet! But you can't submerge all at once, you understand. It takes a little time; not much, but a few minutes; and there wasn't time enough to be swiped from the clock just then. Zip-bang! Zip-bang! and up came the misses' size destroyer, right alongside, with her one-pounder trained square on the periscope and Capt. Yates Stirling squinting over the sights and laughing to beat the band.

"Of course we were out of the game. The skipper and the navigating officer lost their appetite for supper, but they knew they were caught and ran up the signal. One shot in real sea fighting would have sent the D-4 to the bottom with a big hole through her skin.

"Mr. Astor, Capt. Stirling and the mechanic in the hydro-aeroplane shot away from us and hunted for the G boat (the other submarine), but the G people were too foxy. They must have taken a peek or two while the enemy was putting us out of business, and so beat it while the beating was good. Anyway they escaped and got back to the submarine base here. And believe me," said the submarine man, "if the British are using little speed boats with as much go in them as Astor's, I don't see where the Germans are going to get off."

× × ×

Just before going to press we receive news that the "Mann" biplane was taken up to 8,000 ft. by Mr. A. E. Barrs on Tuesday morning. At present we have no information with regard to the time taken for reaching this altitude.



Corner of a Bavarian aero-park at the West front of the war operations.

Everybody up at Hendon has got used to Pickles' steep left and right hand banked spirals on the Curtiss machines, and when one of these happen to be more on the wing tips than with the struts pointing skywards the *habitués* merely give one another a knowing look and say "Pickles!" On Wednesday of last week, however, there was a different note to the pronunciation of the name of the well-known pilot, for without any warning Pickles did two beautiful loops on one of the JN3 Curtiss tractors. In the course of the afternoon this loop was followed by twelve others, six of which were made with a passenger on board. As the machine used was one of the standard Curtiss biplanes with a 90 h.p. OX motor and had not been plumped up for this strenuous performance, the critics who have volunteered the opinion that the Curtiss is not endowed with a sufficiently high factor of safety, will perhaps think it over. "ÆOLUS."

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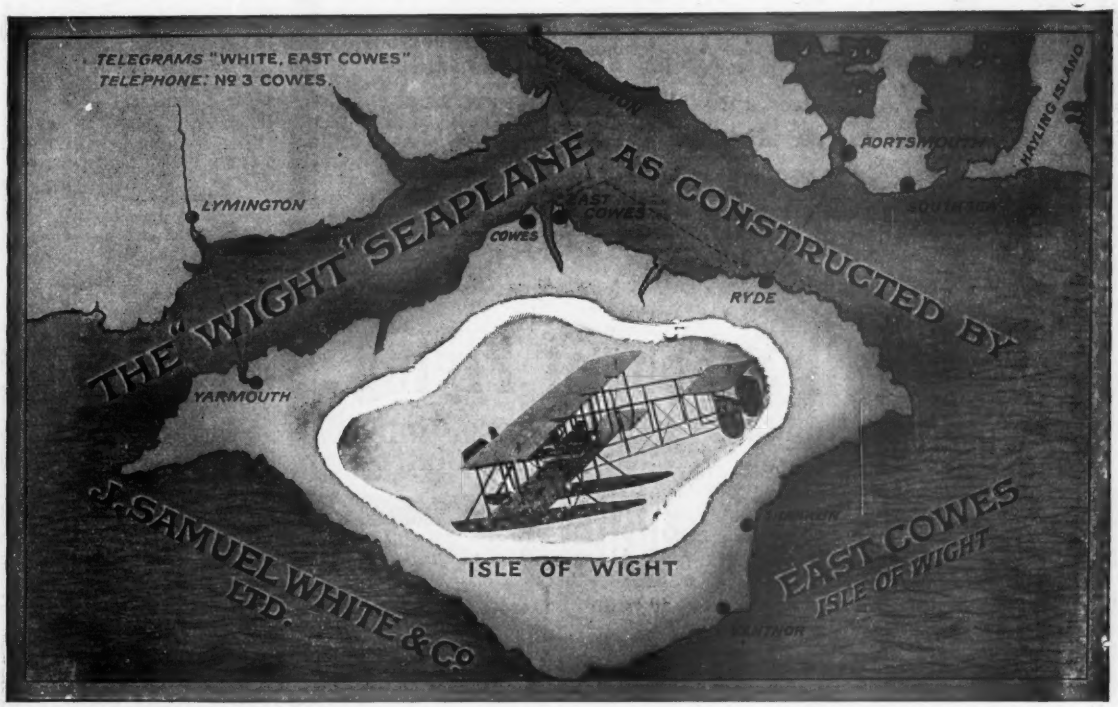

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IN the debate in the House of Commons on the Vote of Credit on the 11th inst. Mr. Joynson-Hicks called attention to the air services of this country. With regard to the military wing, he urged that it was important to take full advantage of the winter for the construction of larger machines with engines of greater power. Last winter the Germans had stereotyped their machines, a much improved form of Albatross, with 150 or 160 h.p. Mercedes engines, being turned out. Owing to the wonderful skill of our aviators, they had been able to beat the German pilots, but they should not be handicapped by having to use smaller machines of lower horse-power. During the winter preparations should be made so that our aviators, when they could resume offensive flying, could do so with high-powered machines capable of long-distance flights. Turning to the Naval Air Service, an incident of whose work was the defence of London against Zeppelins, Mr. Joynson-Hicks said that there was throughout that service a feeling of great dissatisfaction with regard to the existing organisation. In one case a very eminent member of the Royal Flying Corps who had left that service had been taken over by the Royal Naval Air Service and given a responsible position in the Dardanelles above the heads of two men whose names were household words. It was felt that the men who had helped to make the Naval Air Service were being superseded. There was a very grave feeling with regard to the action the First Lord of the Admiralty had taken with reference to the head of the Naval Air Service. If there was one man who had built up the Royal Naval Air Service it was Commander Sueter, but the right hon. gentleman had brought in to supersede him an admiral of high position in the Navy who knew nothing whatever of the air service. There were some quaint anecdotes going round to illustrate the ignorance of that admiral when he first took up the position. The right hon. gentleman had said the other day that it was impossible to reorganise the air service in time of war, but there could be no greater reorganisation than to bring in an untried man and to teach him his business.

Why should everything have to pass through the hands of the Sea Lords? That process involved considerable delay. It would be better to have a director of the air service; something might be done if the First Lord of the Admiralty himself would take charge of the air service. He was told that two months ago an order was passed in for the building of large aeroplanes, such as many hon. members had been asking for for many months past, and that order, if it had yet gone out, went out only last week. It was of the essence of the building up of an air service during the winter that it should be ready in the spring when the Germans would bring out their new Zeppelins and new aeroplanes. Why had we no Zeppelins to-day? Why had no large airship been built? Why was the work on an English Zeppelin stopped in January last? He believed that the construction of that Zeppelin was to be continued, but why had eight months been lost? We knew what Zeppelin raids were, and at least the Government might have provided one big airship which could have patrolled the East Coast and have tackled at least one of the German Zeppelins. Every air station around England ought to be provided with an ample supply of first-rate aeroplanes to attack the German Zeppelins when they arrived over our shores. He was told that there was no cooperation between the War Office and the Admiralty. In reply to another question of his, the First Lord of the Admiralty said he had a great belief in the organising capacity, energy and resource, and openness to new ideas of Sir Percy Scott, who now had the defence of London under his immediate control.

Mr. Balfour: I meant gunnery.

Mr. Joynson-Hicks said that what the people of London wanted to be assured of was that the responsibility for the defence of London was vested not in two or three separate authorities, but in one man, who would be able to order the aeroplanes to go up, not when the Zeppelins reached London, but when they were sighted in daylight over the North Sea. As for the gunnery defence of London, those who had seen the sort of guns which had deluded London so long into the belief that it was defended did not wonder that they failed to hit the Zeppelins 15,000 ft. high at the last raid. Around certain parts of Paris there was a 75 gun, having a high angle range of 19,000 ft., stationed every 300 yards, with a powerful searchlight. That was why Paris was free from Zeppelins. The Zeppelins knew that if they got within range they would be blinded by the searchlights and that the guns would quickly make an end of them. Was not the capital of the British Empire entitled to the same protection as Paris?

But in his view the defence of London should commence on the East Coast. If powerful guns mounted on motor lorries were stationed at intervals along the East Coast and manned by efficient gunners, the Zeppelins would be caught before it was dark, and very soon some of them would be brought down. German aeroplanes, which were only from 20 ft. to 30 ft. across, were constantly brought down at the front. A Zeppelin afforded a much larger target. He suggested that some of the expert aerial gunners should be brought over from France to assist in the defence of London. But really the best defence of London was an offensive against the Zeppelins. Let them be bombed out of their sheds. A fleet of aeroplanes, 2,000 in number, costing only the price of a battleship and a half, and able to drop large bombs, would quickly make a change in the whole conduct of the war. These aeroplanes could cross the Rhine. The exact number and position of the Zeppelin sheds were known to the Admiralty. Let them be destroyed, and the menace of the Zeppelins would disappear.

Mr. Balfour, First Lord of the Admiralty, in replying, said: There is no doubt that, as this war has gone on, there have been changes and developments in the machines of all the countries concerned. Now one has got in advance of the other; now again the positions are reversed. I do not think it ought to be assumed, as both the hon. gentlemen appear to have assumed, that now the Germans have got a lead which it will be difficult or impossible for us to overcome.

Mr. Joynson-Hicks: I certainly did not say it was impossible; I hope we shall catch them up.

Mr. Balfour: I understand that my hon. friend desires to see that British industry and inventiveness shall enable us again to take the lead which we had for a short time, but which in his opinion we have now lost. I can assure them, so far as the Admiralty is concerned, there is an earnest desire to improve in every way the construction of aeroplanes. They are improving in strength, speed, engine power, and all the qualities which he desires to see, and rightly desires to see, embodied in our air service. I believe the Army, although on that point I cannot speak with the same authority—but I am confident that the Army are pursuing the same course in generous rivalry with the Navy. The two departments interchange ideas, and I believe that as the war progresses it will be found that we have not fallen behind those against whom we are matched.

It is very difficult, of course, to speak on this point with confidence, because, until a machine is actually in use, you cannot prophesy, whether the machine belongs to your enemy or yourself, what is going to happen. Germany may have some machine under construction of which we know nothing which may produce results we do not anticipate; and we may be producing machines of which the Germans know little. All that must necessarily, in the nature of the case, be a matter of conjecture. I can do no more than assure the House that, so far as the Admiralty is concerned, and, I believe, so far as the Army is concerned, broadly speaking, it is fully recognised by both departments that there is no more important and pressing necessity at this moment than to see that the machines used by the air service are kept at least on a level with those with whom they have to contend.

My hon. friend went on to criticise certain dispositions of *personnel* for which the Navy were responsible. He complained that we had sent out an Army man—a man trained in the Army Air Service—to superintend and organise the Naval Air Service in Gallipoli, although there were naval men there, as he said, whose names are household words. It is perfectly true that there are members of the Naval Air Service at Gallipoli whose names are, and deserve to be, household words in this country. They are flyers of supreme skill and of admirable and distinguished courage. But the gentleman to whom he refers, who is now at the head of the Service in Gallipoli, was sent out not as a flyer but as an organiser. He is an admirable flyer; but it was to organise a great air service at Gallipoli that he was sent out. I believe he is doing it very successfully, and I believe the heroic aviators of whom my hon. friend speaks are more distinguished for their great feats of courage and skill than they are for their organising powers. The two things are quite different, they require quite different faculties. I think my hon. friend was not well advised in criticising the Government for not having considered the special aptitudes of the men at their command in determining what places they should fill in the service of their country. All I can say is that I have done my best in this matter. I do not believe that he will find that those who look at the air service in Gallipoli from the outside who consider what it has done, what it is doing, and what we still hope it will do, will consider the choice made by the Admiralty of which my hon. friend complains is otherwise than the choice which experience justifies.

My hon. friend turned from Gallipoli to the organisation of the air service at home. He very rightly, I think, avoided unnecessarily dragging in names in the debates in this House. The essence of his charge was that whereas there was a gentleman at the

Admiralty who, up to the recent reorganisation of the service, had conducted all the departments of the air service with conspicuous ability, the Admiralty had now altered the system, had brought the air service under the ordinary Admiralty practice, put it under the Sea Lord, and had, by that very action, necessarily altered the position of the distinguished gentleman to whom he referred.

The facts are these. When the war broke out, the air service was relatively in its infancy. The very fact that the war broke out expanded it enormously in all directions. The distinguished officer to whom the hon. member refers was, in the first instance, an expert in lighter than air ships. Gradually, as the air service expanded, his duties expanded; to lighter than air were added heavier than air. To the design of aircraft was added the control and command of an ever-increasing and enormous staff—designers, and fliers, pilots, and mechanics. He was made responsible for the most heterogeneous duties until the weight of responsibility thrown upon him was far in excess of what any officer ought to be asked to bear. I came to the conclusion that the time had come when the air service ought to be brought under the ordinary Admiralty practice.

In its early days, Mr. Churchill, to whom the country owes a great debt of gratitude in connection with the air service, kept it under his special personal charge and supervision, and I am not sure that my hon. friend did not suggest that his example should be followed by me, and that I should put all the Naval Lords on one side and assume the sole management and control of the air service. I think that would have been a great error. Much was gained by the personal control, the personal interest, the initiative and the farsightedness of my right hon. friend in the early stage of this air service. But I might as well really keep the submarine service, or the destroyer service, under my own personal control. The air service has come to stay. It is, and it must henceforth always be, part of the Admiralty equipment, and I am confident that I was right in thinking that the time had come when the enormous expansion which it had gone through required it to be treated as other great naval services are treated, and put under the same machinery which experience has shown to be, after all, not a bad machinery for managing the affairs of the country.

I hope I have made it clear to the House that what happened was that the enormous expansion of the air service really absolutely outgrew its primitive organisation, and it had to be put under the accepted organisation of the Admiralty. I believe that has done nothing but good. The information I had before the change was made was that in many cases there was great want of discipline in the air service, which was only natural, because the distinguished officer who was at the head of it really had not disciplinary powers, and the various commanders-in-chief round the coast had no authority over the air service at all. It was quite inevitable in these circumstances that there should be some relaxation of the bonds of discipline. It could not be otherwise, and it was not otherwise. I believe it was really of the greatest possible advantage to the air service that it should be introduced into a system which, whatever else may be said of it, has undoubtedly produced admirable fruits in the way of wise discipline. No one has ever suggested that the Navy of this country is not admirably disciplined, and to bring the air service under that system seems to me to be conferring on it one of the greatest possible advantages.

I turn from the general organisation of the air service under the Board of Admiralty to the particular criticisms passed upon the Zeppelin attacks and the defence of London. I do not speak for the Army, because the representative of the Army will speak for himself directly, but, as far as the Navy is concerned, we are doing our very best to increase both the number of our flyers and the machines which they have to use. It is no use saying how much better off we should be if we had more of the things which it is extremely desirable we should have. We are making them as fast as we can. That is a general observation which deals with some points raised by both the speakers.

When we come to the case of Zeppelins my hon. friend said, "Will the First Lord of the Admiralty explain why Zeppelins were not built before the war, and why a Zeppelin which was being built during the war was not gone on with?" I am not going to discuss the policy of the present Board in connection with lighter-than-air craft, though I may say that we are building no inconsiderable numbers of lighter-than-air craft at this moment, largely for the purpose which my hon. friend refers to—the purpose of scouting. If he asks me why these ships were not built before, he must recognise that the whole policy of Zeppelin *versus* aeroplane is still undecided, and that the most competent people hold the most diverse views upon it. No nation, I do not care what nation it is, could expand equally in every conceivable direction. You have to choose, and there are many persons—I do not say they are right, I have not an opinion—who think that Germany chose wrongly. If Germany chose wrongly in the matter, I hope the criticism upon the preceding Board of Admiralty will be mitigated in severity. If the Germans were wrong in putting so much energy, money, skill, invention, and manufacturing power into the making of Zeppelins, do not let us criticise the proceeding Boards of Admiralty because they did not fall into the same error.

But, passing from this general question as to whether you ought to construct Zeppelins rather than aeroplanes, or aeroplanes rather than Zeppelins, I come to the more particular criticisms my hon. friend made with regard to the defence of London. With some of his observations I am in hearty agreement. I quite agree with him, for example, that no small part of the defence of London or any other place within these islands, should largely, and as far as possible, be a coast defence. It cannot be wholly a coast defence. London must have local defences, as well as coast defences, but I entirely agree that we should extend the circle of our defences as far as possible, and, if you can, and when you can, you should catch your Zeppelin as he approaches your shores, and I doubt not that as we get more and more of the necessary appliances for doing so, we shall more and more succeed in that object.

Let me add something to what the hon. member has said. Our defence against Zeppelins should not be limited by the shore, and they are not limited by the shore. You cannot have a ring of cruisers round the island, of course, but it is undoubtedly the fact that we can use, and should use, and we do use our ships of war as far as possible to anticipate and prevent attacks on the metropolis. But all these questions of defence, or gun power, are limited, just as the aeroplane service is limited. It is limited by what we have got. We are making as hard as we can aeroplanes; we are making pilots, and we are making guns; but we are behindhand. We have always been behindhand in this war. It has never been denied. I am not responsible for it. That is part of what I may call the admitted common places of the situation. We have not had and we still have not all the munitions that we shall have, or that we ought to have. Until we have them it is impossible that we shall have the defences entirely satisfactory in their character or amount. They are improving every day. They are much more formidable now than they were, and they will be much more formidable than they are, and I do not think the House will think it reasonable to ask for any further assurance than that which I can most truthfully give them. We have never been supplied with all the guns we want.

We have taken guns from the less necessary places to more necessary places, and there are positions on ships and on land where I would like to have guns where I cannot have guns, simply because the guns are not yet there, though they will be there. The House must accept that as an unfortunate fact which is being remedied, which has for months been in process of being remedied, is from day to day improving, and will get right, I hope, before a not very long time. I do not pretend that we have at this moment, either in London or out of London, all the guns that are desirable or necessary for its complete protection.

My hon. friend dealt with one other point. He said, "Is not your organisation for the defence of the country against Zeppelins hopelessly complicated and confused; would not everything go on smoother if it was under one authority?" I do not think the organisation is the most perfect organisation that can be devised, but I do not quite see how you could work it with one authority. At any rate, it might not conduce to things going more smoothly. The Navy must be concerned, however you put it, because, as I have just explained, the defence at sea is part of the defence against Zeppelins. Therefore if everything on land were put under the Army, you would still have some of your anti-Zeppelin defences under the Navy, and no conceivable arrangement would get rid of that. When you are dealing with a great area like the metropolis you must bring in the police, the Home Office, the County Council, and the Fire Brigade, as well as the Army and the Navy. That represents a large number of separate Departments, but I do not think, so far as my observation goes, that this produces any real dislocation at moments of action. As regards information, the Army and the Navy are in the closest touch. It is quite true that some of the flying stations near London are under the Army, and others under the Navy.

These stations are in the closest telephonic communication. Each knows exactly what is being done at the other stations. There is no difference of policy or principle, there is no division of authority. There is not, and I think there can hardly be, a collision between one and the other, and in these circumstances I greatly doubt whether any of the ills that my hon. friend seems to think follow the system are really to be found. Nor do I see how he would alter that system at present. These are flying stations where training goes on. I am very much dissatisfied with the division of stations, so far as the Navy is concerned, and I am very anxious to have a much larger training school and to unify the training as far as possible in one place. I believe it will be a great saving of

expenditure, and a great increase in efficiency. That would alter the system no doubt of these flying stations round London, but until the new system can be introduced, the flying stations are there, and they have to be used by the Army and the Navy respectively. If we are to hand over our flying stations to the Army without having any other stations, we cannot carry on our training. I will therefore say that this division is an almost inevitable element in the present system. I hope in some respects the system will improve, but I do not think all its improvements will produce a closer co-operation and a greater harmony than now exists between the Naval and the Army Flying Corps engaged in this particular work.

I will not enter upon the vexed question of whether aeroplanes are the best defence against Zeppelins or whether gunfire is the best defence. I believe the highest authorities on that again differ. It must be remembered that the experience not merely of the British Army or of the Navy but the experience of mankind generally is exceedingly limited upon this point, and it is quite natural that great authorities should have different opinions. But as far as we are concerned we desire to bring both to the highest degree of perfection. We are doing all we can to increase the gun defences of London, and we certainly desire to increase also the aeroplane defences of London. But let the House always remember that we have been brought up constantly by this deficiency of material and of trained men. No fairy waving a wand can put that right. It can only be put right by hard work in the Departments concerned, including, of course, the Munitions Department. That hard work is being undertaken to the best of our ability, and such deficiencies as exist I hope will be soon cured.

My hon. friend concluded with the aspiration, in which I heartily sympathised with him, that the time will come when this country will be able to take the offensive in aerial warfare. I think he rather underrated the difficulty of doing that with aeroplanes. The aeroplane at present has not got the range which would make it possible from these shores to do anything important against our enemy. The time may come when the power of the aeroplane will so increase its length of flight, the load it can carry, and its powers of offence that an aeroplane starting from the shores of Norfolk might become a menace and a terror on the banks of the Rhine. But that time is not yet, and there is no use our pretending that it is. The hon. gentleman, I think, is under a misapprehension on one point. He seems to think that the raids lately came from Zeppelins housed and having their base in Belgium. That I believe is not the fact. They come from North Germany, and they come from a distance where at present effective attack on our part is not easy. He may rest assured that, easy or difficult, air attack is an operation of war constantly in our thoughts. We desire as ardently as he does that such an attack may take place. It will always be a matter of difficulty and peril.

My hon. friend in the earlier part of his speech dwelt upon the way in which Paris has been made secure by the very large number of 75 centimetre guns ranged around the city. As aeroplanes increase in power, guns increase in precision and increase in numbers and the skill of those who use the guns increases also, and I am not sure that it will ever be possible for one country to have such a fleet of aeroplanes as to allow it to attack successfully such a place as Essen. It might be so, and I live in hopes that it may be so. But if it is impossible to defend Essen I would suggest that it cannot be very easy to defend London. The area of London is 118 square miles. Essen is a great manufacturing centre, but it does not rise to that. If in the hon. gentleman's view it is possible for us to create aircraft to destroy Essen, it cannot be difficult for the Germans to create aircraft which will cause loss and suffering and destruction in London.

We need not look forward to developments which it is impossible to foresee with accuracy. Let us deal to the best of our ability with the problems of the moment. As to the character of those problems, I am in entire harmony with my hon. friend. I think that the duty of the Admiralty is to develop to the utmost the number of our aeroplanes, the power of our aeroplanes, and the number and the skill of the pilots who have control of them. I think it is the duty of the Admiralty to develop to the utmost the gun protection of London, whether at the coast or whether in London itself, or whether on board ship. These problems are obviously complex and not easy of solution, but they are constantly before the Board of Admiralty, and I hope the country may rest assured that whatever can be done by the Board of Admiralty will be done. I am quite certain the energies of that Board will not be wanting in doing all that may be required in the defences of his Majesty's Dominions.

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THE WORK OF THE R.F.C.

THE following interesting story of the work of the Royal Flying Corps written by Mr. Philip Gibbs, from the British General Headquarters, appeared in the *Daily Telegraph* of the 15th inst. :—

"Conditions of this war would be utterly altered if aerial reconnaissance were made impossible. The knowledge we have of our enemy's movements, and their knowledge of ours, would be restricted to an astonishing degree, and something like profound ignorance would reign on each side of the trenches. Our aviators are the eyes of the Army, and it is mainly due to their audacious vigilance that we are able to obtain quick information of the enemy's movements of troops from one part of the line to another, of gun positions, of trench geography, and of our artillery results. Unfortunately the enemy has the same service, carried out with not less valour, so that here, as in most aspects of this war, neither side can claim a supreme advantage.

"This at least can be fairly said. That unless we had had a number of efficient air-pilots at the outbreak of the war who were able to raise and train a large body of young enthusiasts with extraordinary rapidity during the war, the work of our armies in the field would have been sadly handicapped, and our gunners especially would have been like blind men fumbling in the dark compared with the present accuracy of their range-finding. Of the courage of these men of the Royal Flying Corps it is impossible to write too much praise. Scores of times I have seen them in flight above the German lines, with shrapnel bursting all round their planes, so that they seem to be sailing to certain death. They escape, by their own skill, or by just the fluke of luck, time after time, but it is not work which looks more dangerous than it is—a spectacular exhibition with little risk.

"The danger is constant and real, and these men know that every time they get into their saddles for a reconnaissance within range of the enemy's guns they are playing a game of hide-and-seek with death.

"German Losses.

"Take the German losses over a period of a few months, and the risks of the air service in war are apparent. The official returns for the air squadrons alone were in June of this year 53 killed, wounded, and missing, in July 43, in August 89, in September 79. I do not know our own figures—I believe they are as nothing compared with the enemy's losses. But the skill of our men in manœuvring and the cool courage with which they engaged in aerial duels do not eliminate the hazards of their adventures. The number of hairbreadth escapes, even in one month's work, would make a long and thrilling record.

"A typical episode happened on November 4th. A flight captain and a second lieutenant were engaged in artillery observation when they were attacked by a huge hostile pusher machine—that is, a machine with its engine and propeller behind the wings—closely followed by three tractors—or machines with forward engines and propellers. Our officers immediately opened fire upon them, using one drum containing the cartridges of the Lewis gun. The pusher was hit and flew off at once, followed by two others. The remaining one engaged our aeroplane, chased it in full flight, and then, while it was manœuvring for position, dived underneath its wings and fired as it passed. The flight captain was wounded in the right arm and the petrol tank was pierced.

"Two other flight officers of ours on patrol duty saw the machine mentioned above closely pursued by a German monoplane, and they made a steep dive towards it like a swooping hawk. The Germans saw their danger, and making a swift turn flew straight beneath the wings of the British aeroplane, passing at about thirty yards below. Half a drum was fired at them, but they turned again and spiralled three times round our men, while both machines were dropping rapidly. Suddenly the Germans decided to make off, and flew away at a great pace, but they were followed at about eighty yards distance by our machine, which fired the remaining cartridges in the drum. Some of these shots were aimed true. The German monoplane turned right-handed and banked steeply, then toppled upside down, and plunged to earth just inside our lines. The pilot and observer were both killed.

"A Close Shave.

"On the same day, in a different neighbourhood, two of our flight lieutenants had a very close shave, and in spite of the great spaciousness of the sky, found themselves in a tight corner. They were making a reconnaisance as a matter of ordinary duty, when a German Albatross came out of the clouds and passed them at a range of 200 yards. They were on the *qui vive* for an attack from this particular bird, when suddenly they heard firing behind them. They turned sharply to the right and discovered another Albatross. At the same time, as if two were not enough, a hostile aeroplane bore down swiftly with a continual rattle of bullets from its machine gun. The two flight lieutenants got their Lewis to work and drove off the monoplane, but the Albatross manœuvred round

and round in a most sinister fashion, and for nearly twenty minutes fired continually at our machine. Fortunately their shooting was not so good as the skill of the British officers in manœuvring out of the range, and after this long duel the hostile aeroplanes swooped away, leaving the British machine alone, and untouched.

"Two sergeants in one of our flying squadrons had a perilous time when they were dropping hand grenades and flechettes (steel arrows) over a town occupied by the enemy. A German monoplane gave chase, and one of our men was hit in the hand and had his face grazed. When reaching out for his rifle he was wounded in the other hand. The pilot made a steep dive towards our lines, closely followed by the enemy, and at this critical moment he was hit by a bullet in the leg, and another shot put the engine out of action. For a moment or two the situation may have seemed hopeless, and death certain, but with steady nerves the pilot succeeded in landing within our lines, and a British biplane appeared in sight and drove off the enemy.

"Skill and Daring.

"Out of all the experience of these air combats continual proofs of the stability and apparent safety of the new types of aeroplanes emerge in a most striking way. Often when I watch our military machines setting off from their grounds with the regularity and assurance of motor-cars from a garage, my thoughts go back to the days—only a few years ago—when the first feeble tentative flights were made, and when I saw so many brave pioneers of flight dashed to earth by a sudden slight gust.

"Even now they look such gossamer things up here above the battlefields of Flanders when the wind is moaning and beneath the smoke of artillery bombardments. Yet they make audacious swoops and dives and turns with bird-like grace and ease, and men 3,000 ft. from earth or more clamber upon those thin struts and canvas planes, in moments of peril, as though this insubstantial structure were a racing yacht and the air as buoyant as the wave.

"When, for instance, a corporal in one of our air squadrons was followed by two hostile aeroplanes he shifted his gun from its position in the front to the rear mounting, from which he could fire at his pursuers. This was done in full flight, and when the enemy's machines made a downward swoop upon our own aeroplane from the prodigious height of 1,000 ft. firing through our men's propellers. The handy alteration of the gun position secured a quick result. After firing half a drum of bullets the corporal saw the leading machine tail-glide for a fraction of a second and then plunge to earth in a vertical nose-dive. The pilot watched the machine go down in this way for several thousand feet, and then it fell among some trees, and a cloud of dust was evidence of its fate. The other machine gave up the fight and disappeared.

"One of the most remarkable and gallant examples of changing the weight and balance in a machine happened on October 26th. Two of our flight officers taking photographs over the enemy's ground were attacked by a Fokker at a height of about 7,000 feet. While getting his gun ready the observing officer was hit in the left hand so that he could not use the weapon. The pilot kept manœuvring to avoid the fire from the enemy's aircraft, but was hit in the arm and shoulder, and lost consciousness. Greater danger can hardly be imagined. High up, and without a guiding hand, the machine rocked and swayed about in a giddy spiral, which was the first sign to the observing officer that his companion was out of action.

"Seeing the pilot limp and senseless, the other officer climbed over between the two back struts and caught hold of the control lever. He moved this about, but nothing happened. He then tried to close the throttle. This did no good, the wire apparently having been broken. Finally he turned off the petrol, and, getting the machine under control, managed to land it behind the French reserve trenches. It was a rough landing, and the machine was flung over, so that the wounded pilot was thrown out. He lay there in a pool of blood until assistance was brought by the observing officer (who climbed out safely) from the French Red Cross. They were still under fire, however, and another observing officer who happened to be with his machine in the neighbourhood, managed to reach the scene and rescue the Lewis gun and instrument board.

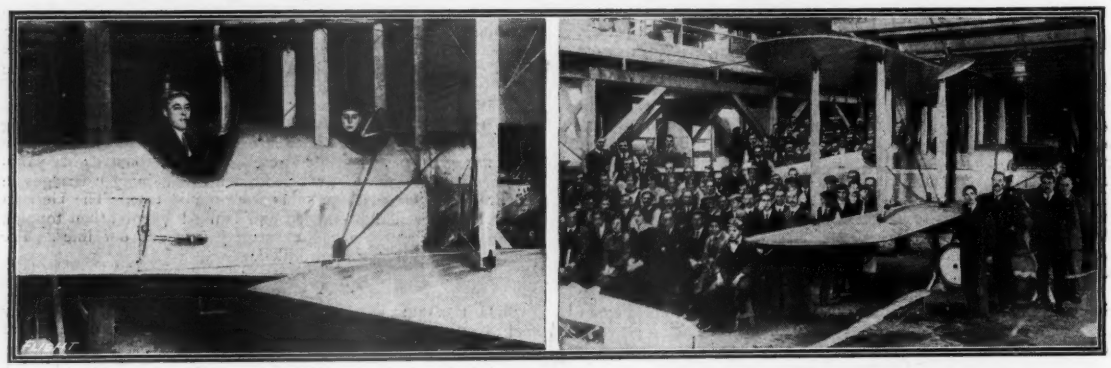
"No Mercy.

"Although there is no mercy on either side during these acrid combats, the battle of the air is enlivened by some of those little touches of chivalry and gallant humour which belonged to old-fashioned warfare. Most of the German flight officers are young men of good social standing, all the observers having the rank of officer also. There is a great aeronautical school at Berlin through which many of them pass before qualifying for active service. The training consists of flying observation, use of machine-gun, bomb-dropping, photography, wireless telegraphy, and a special course of shooting in the air on hostile aircraft. All observers have to pass a standard test before being sent up on reconnaissance.

"Our men will often fight with two. More than that is too much, even for the most audacious, and certainly few men have had the luck of a certain young officer who on October 28th had a series of combats. Going out in a Morane "Parasol" on escort duty to a photographic reconnaissance, and flying at 10,000 ft., he saw an Aviatik 500 ft. below, and dived towards it as he fired his machine-gun. The German turned towards his own lines, but the Morane was then attacked in the rear by two more Aviatiks, which opened fire at 150 yards. Nothing daunted, our aviator fired at them both and made them beat a quick retreat.

"A fourth Aviatik now opened fire from above and swept past the Morane into its own lines with its propeller stopped. Even this was not the last of that hostile flight of birds, and when the officer was going back to the aerodrome he met still another Aviatik, which he chased for about fifteen minutes until it escaped over its own lines.

"All these adventures happened during the last few weeks. They belong to the daily routine of the Royal Flying Corps, which has done fifteen months of splendid service."



Mr. J. A. Whitehead has been "hustling" at his Richmond factory in connection with the Whitehead Aircraft Co. and the building of aeroplanes, a notice of the christening of the first offspring—"Helène"—being given in "FLIGHT" recently. Above are two postcards of a series which Mr. Whitehead is issuing. On the left is Mr. Whitehead himself in the machine with his little child, and on the right is a snap of the first machine in the factory, with some of the work-people who are associated with the Company.

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By ALGERNON E. BERRIMAN, M.I.A.E., A.F.Aë.S., Chief Engineer of the Daimler Co., Coventry, England.

(*Continued from page* 884).

The Virtue of a Cambered Wing.

Cambered wings are used instead of flat plates because they are more "efficient";* that is to say, because the ratio of their lift to their resistance is higher than obtains for a flat plate. The reason

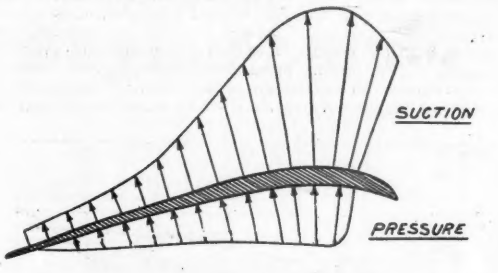
SUCTION
PRESSURE
GRAPHIC ILLUSTRATION OF A TYPICAL DISTRIBUTION OF PRESSURE OVER A WING SECTION AT ABOUT SIX DEGREES ANGLE OF INCIDENCE

Fig. 4.—Diagrammatic illustration of the distribution of pressure along the chord of a wing. This distribution varies very much with the angle and the section of the wing. An important point illustrated above is the forward tilt of the suction vectors immediately over the front edge of the wing. These give rise to an up-wind component that materially reduces the resistance to flight, and makes the cambered wing section much more "efficient" than a flat plate.

for this virtue is to be found in the inequality of the pressure distribution, notably over the upper surface,† (See Fig. 4.)

A remarkable fact associated with this distribution is the high intensity of the negative pressure (suction) immediately over the front edge of the wing when it actually faces the wind, and should, therefore, apparently be subjected to a positive force of direct impact.

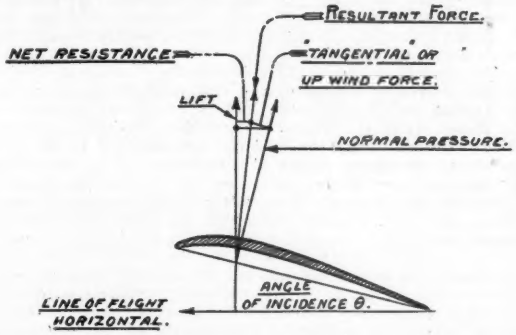

Fig. 5.—Vector diagram illustrating the effect of the up wind component in reducing the resistance of a cambered wing section. A pressure P, normal to the chord, would give rise to a resistance P sin. θ, but the existence of the up-wind tangental causes the resultant to be inclined forward from the normal, and so reduces the net resistance. This diagram should be compared with Fig. 4, as an alternative method of illustrating the same principle.

Owing, however, to the existence of what Lanchester describes as the "cyclic upcurrent,"‡ the relative wind always approaches the wing with an upward trend, so that the dipping front edge of the cambered section is actually on the lee side and receives the full benefit of a very intense suction that much exceeds the force exerted elsewhere.

The supreme significance of this phenomenon is at once apparent. Although in the lee of the local air flow, the dipping front edge of the wing still faces up wind, and any suction on it is bound to exert a propelling force in the direction of flight. Where the pressure distribution is uniform (as it becomes beyond the critical angle), this up-wind component, which Lilienthal called the "tangental,"§ would be neutralised by the downstream drag on the trailing portion of the wing; but at small angles of incidence the negative pressure predominates on the front edge, and the cambered wing is consequently remarkably meritorious. (See Fig. 5.)

Whether it be a flat plate or a cambered wing, however, it is always the upper surface that contributes the greater part of the lifting effort. In general, it may be said that wing sections, as used on aeroplanes of to-day, derive three-quarters of their lift from the suction on their upper surface. (See Fig. 6.) Arising out of this, it follows that alterations to the lower surface profiles are of relatively small importance; indeed, experiments have shown that the lower surface may be flat without serious detriment to the lift coefficient. There is a great practical advantage in this fact, inasmuch as it enables sufficiently deep spars to be incorporated in

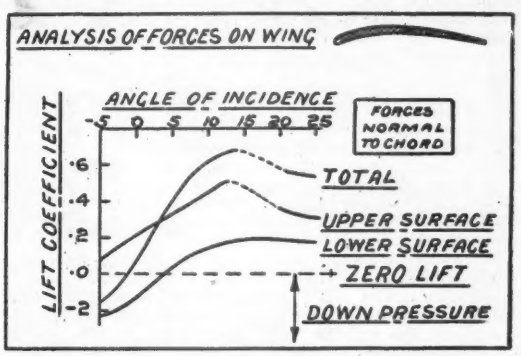

Fig. 6.—Diagram constituting an analysis of the forces on a wing in flight, showing the relationship of the suction on the upper surface and the pressure on the lower surface throughout a range of angles. It will be noticed that there is a down pressure (suction) on the lower surface at angles of incidence less than about +5°, whereas the upper surface continues to lift when the angle of incidence is as much as −5°, *i.e.*, below the horizontal. These numerical values will vary widely according to the wing section. The graphs given above are taken from the Technical Report of the Advisory Committee, and relate only to one particular wing section.

the wing structure without destroying the aerodynamic virtues of the section

Just as in the case of the body, so in the case of the wing has an aeroplane designer every reason to study the results of experimental research. Either he must adhere closely to existing forms, or he must institute an elaborate system of experimental investigation in order to establish his data. Such research as is here implied is ordinarily beyond the means of a private firm, and the work of such laboratories as those of the N.P.L.‖ and Eiffel is therefore of invaluable service to general progress.

Having now scanned the chief features of aeroplane resistance, it may be of interest to give a few numerical values, in order to fix ideas, before passing on to an equally brief consideration of the question of stability.

* It is difficult to find a better word than "efficiency," although its use is not justified technically.

† For charts of pressure distribution, see "Technical Report of the Advisory Committee for Aeronautics," Vol. 1911–12, p. 60; also Eiffel's "Resistance de l'Air." Particular attention is also directed to the conclusions in the "Technical Report," Vol. 1912–13, p. 101, where it is shown that a remarkable difference in efficiency obtains in the centre and at the tips of a wing.

‡ For an explanation of the nature of this phenomenon, see Lanchester's "Aerodynamics," section 110.

§ See Lilienthal's chapter on "Artificial Flight," in Mordebeck's "Pocket Book of Aeronautics," p. 287

‖ The research of the N.P.L. on Aeronautics is published in the "Technical Report of the Advisory Committee for Aeronautics." The research of M. Eiffel's laboratories is published in Fiffel's "Resistance de l'Air." For the records of M. Riabouchinsky's research, see "Le Bulletin de l'Institute Aerodynamique de Koutchino," published by the Institution at Koutchino. The records of Prof. Prandtl's research at the Göttingen model-testing institution are generally published in the German periodical "Zeit für Flugtechnic und Motorluftschiffahrt."

Taking first the question of wing resistance, this is commonly in the order of 1 lb. for every 12 or 14 lbs. supported in flight; but, according to Lanchester,* "if it is found practicable to employ a really high aspect ratio,† there is every reason to suppose that a resistance coefficient as low as 6 per cent., or even 5 per cent., may prove to be attainable." In his "James Forrest" Lecture to the Institution of Civil Engineers last year, Mr. Lanchester expresses the aggregate body resistance as an equivalent flat surface measuring, in the case of modern machines, about 5 sq. ft. in area. His remarks on the future are as follows:—

"If we take an aerofoil coefficient of 7 per cent., and a curve representing 3 square feet equivalent normal plane, we find that at 80 miles per hour the gliding angle, or the resistance coefficient, should be approximately 12 per cent., and at 60 miles per hour 10 per cent.; I believe this figure to be in sight, though it may not yet have been actually reached" . . . . .

"If we try, in the light of present data, to look into the future, it seems probable that the limiting gliding angle, or, rather, the minimum total coefficient of resistance, may even be materially less than 1 in 10; thus, if it is found possible, in spite of structural difficulties, to obtain in an actual machine results equal to those obtained in wind-channel model tests, namely, a coefficient of resistance for the aerofoil approximating to 5 per cent., and if the body area equivalent, for a machine of 1,200 lbs. gross weight, can eventually be reduced to 2 square feet, a total coefficient of resistance as low as 8 per cent. may prove well within reach. Whether the sacrifice necessary in order to achieve such results in practice would be justified, the future alone can decide. The solution of an engineering problem is always to some degree a matter of compromise, and it would be rash to suggest that in the case of the flying-machine there are not considerations of sufficient importance to render it inadvisable to run after the last 1 per cent. reduction in tractive effort."

The Power Required for Flight.

Taking the case of any particular aeroplane already constructed it is apparent that the nature of the resistances it encounters in flight renders it necessary to plot a graph in order fully to record the conditions. Thus, on the one hand, there will be the resistance of the wings, which will at first decrease with increasing speed as the attitude approaches the speed of least resistance, and afterwards will increase again. On the other hand, there will be the body resistance, which increases rapidly with the speed from first to last. These two resistances form separate and intersecting graphs on the resistance chart, and must be combined to form the total resistance. If the thrust available for the propeller is superimposed, a characteristic chart is thereby constructed, which forms a key to the anticipated speed and climbing qualities of the machine. Graphs of this character were introduced by the Royal Aircraft Factory to express the anticipated and actual results of their machines. (See Fig. 7.)

The two points of intersection between the propeller thrust and aeroplane resistance curves indicate the speed range, and the lower of these two limits is that in which the machine assumes the *cabré* attitude that has been described as so potentially dangerous. At any given speed on the chart the reserve thrust is indicated by that part of the ordinate, measured to scale, which is intercepted by the two curves.

The product of this thrust by the flight speed gives the reserve power available for acceleration. If the attitude of the machine is adjusted to a path of ascent, so that the flight speed through the air remains constant, this reserve power may be utilised for climbing, and the rate of vertical ascent can be estimated from the reserve power available and the total weight to be lifted.

From a mere consideration of two facts, viz., that a machine must be able to fly slowly (40 m.p.h. or thereabouts) in order to alight with safety on indifferent ground and when piloted with very moderate skill, and yet must be able to fly fast in order to make headway through a strong wind or to escape a superior force of its enemy in war, it is apparent that a wide speed range is of fundamental importance in any generally useful aeroplane. This, in turn, as can be seen from the characteristic chart of aeroplane resistance, calls for a reserve of power and accounts for the fact that the engines have steadily tended towards larger sizes, especially of late years.

If we take an imaginary case of an aeroplane weighing 1750 lbs.‡ experiencing a resistance of 1 in 7 at 60 m.p.h., the power necessarily expended on level flight is 40 h.p. If the power available at the propeller is 60 h.p., the reserve at 60 m.p.h. is 20 h.p. and the estimated rate of climbing is nearly 380 ft./min. In the military aeroplane trials of 1912, the climbing rate ranged from 105 to 365 ft./min. The present climbing value of one of the British Government's aeroplanes‖ is from 400 to 450 ft./min.¶

Prior to the war, one of the most used engines was the 80 h.p. Gnome, which develops 64 h.p. on the brake. It is now less widely used, owing to the growing demand for engines capable of giving at least 90 h.p. effectively and continuously. In the near future, engines of over 200 h.p. will undoubtedly be in use on the larger types of aircraft.

As most people are aware, the aeroplane motor, although similar to the motor-car engine in its fundamental principles, is, as a rule, of a very different description. In the early days it was not unknown for sportsmen to take engines out of their cars in order to equip their aeroplanes, but the engine in such cases continued to evince a distinct preference for the support of *terra firma*. Exigencies of weight forced designers of aeroplanes to seek lighter motors, and the

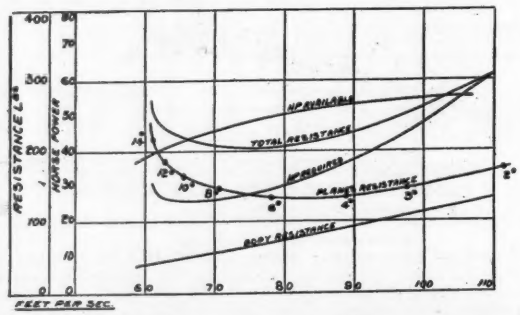

Fig. 7.—Chart serving as an analysis, or synthesis, of aeroplane resistances. The resistance of the body, which comprises also the struts, wires, landing carriage, &c., is shown by its graph to increase rapidly with the speed. The resistance of the wings is shown by its graph to decrease rapidly until an angle of about 5° is reached, beyond which point the resistance increases again as the angle becomes finer. The sum of the two resistances produces the total resistance curve, which is seen to have a minimum value at about 75 m.p.h. The product of the total resistance by the speed produces the graph of horse-power required. The graph of horse-power available at the propeller is superimposed on the chart from known data. The ordinates intercepted between the two horse-power curves, measured to scale, gives the reserve power available for acceleration or climbing. The above chart is for a particular aeroplane and is taken from the Technical Report of the Advisory Committee. The method, however, can be applied to all machines, and is regularly employed at the Royal Aircraft Factory. Particular attention is drawn to the obvious danger of forcing the machine to fly very slowly at very steep angles of incidence. The proximity of the two horse-power curves on the left of the diagram illustrates the absence of reserve power in case of emergency, and Figs. 2 and 6 show that the wing may suddenly pass the critical angle and so lose its lift in this region.

Wrights, it will be remembered, had to build their own engine for their very first machine. Many attempts to produce a satisfactory aeroplane engine was made in different quarters before the Gnome rotary motor was produced. The advent of this remarkable machine gave a great stimulus to practical flying, but its influence on competitive engine design seems rather to have damped than inspired progress. Being a type apart, and having a quality of lightness only readily to be attained by following the basic principles of its design, its success rapidly developed into a virtual monopoly that was somewhat deterrent to new enterprise. Neither its lack of economy in fuel and oil consumption nor its need for frequent attention have much militated against its utility under flying conditions as these have existed hitherto, but it is quite certain that aeroplane engines of the near future must attain in these respects more nearly to the standard of those employed on automobiles. Indeed, fuel and oil economy rapidly attain a greater importance than the actual weight of the engine when long duration flights are considered.

(*To be continued.*)

* See Lanchester on "The Flying Machine from an Engineering Point of View," Proceedings of the Institution of Civil Engineers, Vol. CXCVIII, 1913–14.

† Ratio of span to chord in a wing.

‡ The weights of aeroplanes in the Military Aeroplane Trials, 1912, varied from 1,481 lbs. to 2,680 lbs. with pilot and 4½ hours' fuel and oil.

§ For an analysis of these trials see "Aviation," p. 272.

‖ See "Technical Report of the Advisory Committee for Aeronautics," 1912–13, p. 248.

¶ One of the R.A.F. experimental machines climbed 900 feet in one minute (see "Technical Report," 1912–13, p. 265).

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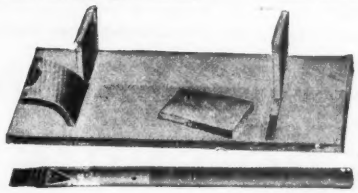

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AIRCRAFT AND THE WAR.

A REUTER message from Rome on November 14th stated:—

"It is semi-officially announced that hostile aircraft have dropped bombs on the Piazza delle Erbe at Verona, which is nowhere near any military buildings of any kind and is always crowded with people.

"Thirty persons were killed, 29 seriously injured, and 19 slightly injured.

"The raid was made this morning by three Austrian airplanes, which dropped 15 bombs, practically all explosive, on various parts of the town, but it was the Piazza delle Erbe, the chief square of the town, where the market is held, which suffered most and where there were most victims. One bomb alone which fell here killed 19 persons. The damage to property is not important."

A message from its Belgian frontier correspondent published in the *Telegraaf* of the 18th stated:—

"During the bombardment a few days ago by Allied airmen of the region of Lichtervelde, near Thorout, five bombs fell on a big motor-car shed, destroying ten automobiles and wounding thirty German soldiers. There must also have been some killed, but the number is kept secret."

A Central News message from the Hague on the 15th stated:—

"According to reports received from Frankfort, a Zeppelin airship has been wrecked near Grodno. Flying over Russian positions, the airship was damaged by well-aimed artillery fire. The dirigible then returned over the German positions, where near Grodno an emergency landing had to be effected. During the landing the Zeppelin took fire, and the greater part of it was destroyed. The crew were saved by soldiers."

A Reuter message from Paris on November 15th stated:—

"A German aeroplane to-day dropped several bombs on a suburb of Dunkirk. There were some civilian victims."

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ARMOURED CAR SQUADRONS AND MR. CHURCHILL.

A TRIBUTE to Mr. Winston Churchill's work in the organising of the Armoured Car Squadrons, originally formed in connection with the R.N.A.S., was paid at the House of Commons on Tuesday, when he was presented by officers of the squadrons with his portrait painted by Mr. John Lavery. Among those present at the ceremony, which was quite informal, were Mrs. Churchill, Mr. J. King, M.P., Mr. J. Lynch, M.P., Mr. O'Malley, M.P., Lieut.-Commander Wedgwood, M.P., D.S.O., Commander Locker-Lampson, M.P., Commander Perrin, Commander Bell, Commander Cooper, Commander Gregory, Lieut.-Commander Whittall, Lieut. Hanna, Lieut. Ingle, Lieut. Demuth, Lieut. Woodward, and Assistant Paymaster Sykes.

In making the presentation Lieut.-Commander Wedgwood said they were there as officers of a force which Mr. Churchill established and which had proved invaluable. Early in September, 1914, Mr. Churchill, having set the Royal Naval Air Service on its legs, determined to establish a land force to work in co-operation with it and to assist, according to the intention then held, in keeping the remains of Belgium clear of the German hordes. By October, so great was the speed and energy which he put into the work, the armoured cars were in the field. They were in Lille, Tournai, Douai, Antwerp, and along the Scheldt—in short, wherever there was fighting. Since then they had been used in South Africa, East Africa, West Africa, Gallipoli, and France. In Gallipoli the guns were also used separately and were still being used in the trenches. In France, under the Duke of Westminster, they were of great service in the battles of Neuve Chapelle and May 9th; on one occasion they filled a gap in the lines and saved a regiment of cavalry which had been left "in the air." Commander Oliver Locker-Lampson had a contingent now working with the Belgian Army.

Commander Locker-Lampson, M.P., thought the D.S.O. conferred on Lieut.-Commander Wedgwood was evidence of the value of armoured cars in the part of the world where he worked.

In accepting the gift, Mr. Churchill said he felt that the armoured-car service had justified its creation. The course of the war in the West had not been of a character to give proper scope to engines of this character. They were devised at a time when the right flank of the German advance was open and exposed to attacks from the sea coast, and to work in conjunction with the aeroplane squadron, which the Admiralty was asked in the beginning of the war to maintain in France and Flanders. Where conditions of manœuvre prevailed and armies are moving swiftly to and fro the power of the armoured car and its value would be inestimable.

In spite of the conditions which had ruled, the cars had made themselves extremely useful and valuable, and they had played their part. If ever the line should break, either in a favourable or an unfavourable direction to us, the value of the armoured cars would be appreciated even more widely than at present. He added that he would value the portrait for its own sake as an excellent work of art, and because it had been presented to him quite unexpectedly by those who belong to the service which he had the honour to raise.

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"Life is a mirror—smile at it and it will smile back; frown at it and it will frown again."

From *Punch's* Almanack, 1916.

INTELLIGENT FEMALE (*watching the sausage observation balloon practice, to Observation Balloon Officer*): "I wonder you don't have a ladder, or a fire escape, or something of that sort, instead of just that rope to climb up and down."

! ! !

HOUSEHOLDER (*somewhat startled by descent of Service balloon, with disastrous effects upon his precious pergola*): "So *this* is what you Navy aircraft gentlemen do for a living!"

! ! !

FOREMAN PRINTER (*to Sub-Editor*): "We can't do with any more air-raid copy, mister. We've used up every 'Z' in the place!"

! ! !

TODDLING BOY (*to Nurse with baby in perambulator, all gazing heavenwards*): "What a lucky beggar baby is, Nurse! Never has to strain his neck looking for Zeppelins!"

Zeppelism.

"I MUST have been in bed an hour when I was awakened by an awful crash," wrote the wife of a "Tommy" at the Front—the letter being quoted in the *Daily Dispatch*. "I knew it was them Zepps. There was another terrible bang. I took my clothes off the chair, shoved them on a hook, gripped baby, and ran downstairs to the cellar. Dear ——, you must not blame me.

"It was horrible. I wondered why baby didn't cry. I looked at the dear. Dear ——, it was a good job he had a strong nightie on, I know you'll forgive me. If you only knew what I went through. I had hung baby upside down on the wall by the hem of his nightie, and was nursing the big pillow with lace frills. The poor kid. . . ."

! ! !

Aerodrome Proberbs.

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COMPANY MATTERS.

Sunbeam Motors.

AT the annual meeting of the shareholders of the Sunbeam Motor Car Co., Ltd., held at Wolverhampton, Mr. John Marston (chairman of directors) presiding, in moving the adoption of the report and balance-sheet, said the company was now a controlled establishment, and since last March their energies had been entirely at the service of the War Office, the Admiralty and the Allied Governments. They had supplied a very large quantity of cars and ambulances to the War Office and large numbers of aviation engines (the Sunbeam-Coatalen) to the Admiralty. This engine had been the result of many months' experimenting by their brilliant engineer and designer, Mr. Coatalen, and they believed they had succeeded in producing an engine that could not be beaten, having regard to the work it had to accomplish. At the further request of the Admiralty, the company had taken up the manufacture of waterplanes.

All the departments had been kept during the year in full work, and the result was a handsome profit of £240,000. The company a year ago contributed £500 to the Prince of Wales' Fund, and this year they had contributed numerous sums of money to various relief funds, and in response to an appeal from the French Red Cross Society had sent them a fully-equipped ambulance similar to those supplied to the War Office.

Mr. W. M. Iliff, in seconding the motion, said they could congratulate themselves upon a remarkable balance-sheet. In fact, a financial paper had called it "romantic." Since their incorporation they had strengthened their position year by year, had never paid dividends which they could not afford; and to return an average of about 16½ per cent. by way of dividend, build up reserves by more than equal to the capital (paying the shareholders a bonus of 10s. a share early last year, thus utilising £60,000 of the reserve), to show the turnover and profit they did on capital taken with the other growths from the small beginning in 1905 did approach the "romantic." This year's result had not been attained by sitting down and waiting for Government orders. The profit also had not all been made out of the Government. Early in the season they supplied a good number of cars for private trade, both at home and for export. They had also supplied quantities of cars for Russia, and had supplied and were supplying their aviation engines to that country and France, in addition to our own Government. The making of seaplanes was an entirely new departure. They had built and were equipping the new factory entirely out of their resources, without appealing to the shareholders for additional capital. When the company was formed in 1905 the works covered approximately an acre of land, but the total area now amounted to about 30 acres. Their cars and ambulances gave every satisfaction, and many unsolicited testimonials from the Front had been received. While the war lasted they anticipated having to send all their products either to our own Government or to one of the Allies, but when the time came they would not be behindhand in energy and resource to grasp the private trade both at home and abroad. When the war broke out they had export contracts and orders amounting from £60,000 to £70,000 cancelled. In every way the year's work had been very successful, and he acknowledged the loyalty of the staff, but for which the labours of the management would often fail.

Mr. Louis Coatalen (joint manager), in supporting, said the company would shortly put on the market another aviation engine of 300 h.p. It had only been possible to produce this engine through the lessons learned by their long experience in producing racing engines, so it was a vindication of the racing policy adopted by the Sunbeam Company. Not only had the racing policy secured the company priceless advertisement, but the experience gained with the highly efficient motors had enabled the company to supply aviation engines one month after war was declared. It was the opinion of all experts that the next war would be fought in the air, and there was nothing surprising in this statement considering the extraordinary progress which had been made the last two years, and undoubtedly all nations would have to have big air fleets to protect themselves against air invasions. As aviation progressed more and more horse-power was required by the makers of flying machines, and now they had reached the stage at which engines were required to give 300 h.p. This new industry of the Sunbeam Company had been extended beyond all expectation, and represented a far bigger business than had ever been done in motor cars, so it would be realised what a valuable asset this would be. Even should there be a big slump in the motor car trade the company could still easily maintain its rate of profit on aviation engines alone. Moreover, they had a third string to their bow in the building of complete flying machines. The first waterplane had been delivered and had made a successful flight. The company had in hand from the Admiralty orders for complete machines worth thousands of pounds, and this in itself would prove a very remunerative adjunct.

Needless to say, the dividend, bonus and other recommendations were agreed to, whilst the directors were voted a remuneration of £4,500 by way of a small recognition of their whole-hearted work on behalf of the shareholders.

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The S.M.M.T. Aero Committee.

MR. J. E. HUTTON having resigned the chairmanship of the Aero Committee of the Society of Motor Manufacturers and Traders, Mr. H. White Smith, of the Bristol Company, has been elected to the position.

Death of Lady White.

THE full sympathies of the industry will go out to Sir George White, the head of the British and Colonial Aeroplane Co., and other "Bristol" concerns in the great bereavement he has suffered in the death of his wife, which took place on Monday. Lady White took a keen interest in aviation, and had laboured hard since the start of the war in connection with Red Cross work.

Anti-Aircraft Risks.

CONCLUDING a lecture on "War Risks to Property" before the Auctioneers and Estate Agents Institute on the 11th inst., Mr. Sydney A. Smith expressed the opinion that as war was a national disaster, and aircraft and bombardment risks followed from it, the fairest plan would be for the nation to compensate owners fully; and he believed this was the opinion of a good many people. However, the Government insurance scheme had been prepared to meet an emergency, and it was the duty of estate agents to use their best efforts to insure its success.

Dealing with the question as to who was responsible for insuring leased properties against aircraft damage, Mr. Smith said responsibility as between landlord and tenant depended upon the express or implied covenants between the parties. Express covenants to repair and to maintain the property and so deliver it up would, it was thought, include this responsibility, and tenants who were not under covenants for the maintenance of the property would still find the position unsatisfactory to them, as it was generally assumed that any tenant would, in law, be liable to continue to pay rent, even though the premises were rendered uninhabitable. The cost of insuring rent was so small that it should never be neglected by tenants.

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A Sign of the Times.

It is not without interest at the present time to notice that auctioneers and estate agents in detailing the advantages of the properties which they have to offer, wherever possible include an allusion to the effect that it is situated outside the danger zone of Zeppelins.

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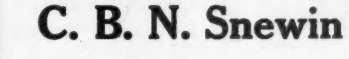
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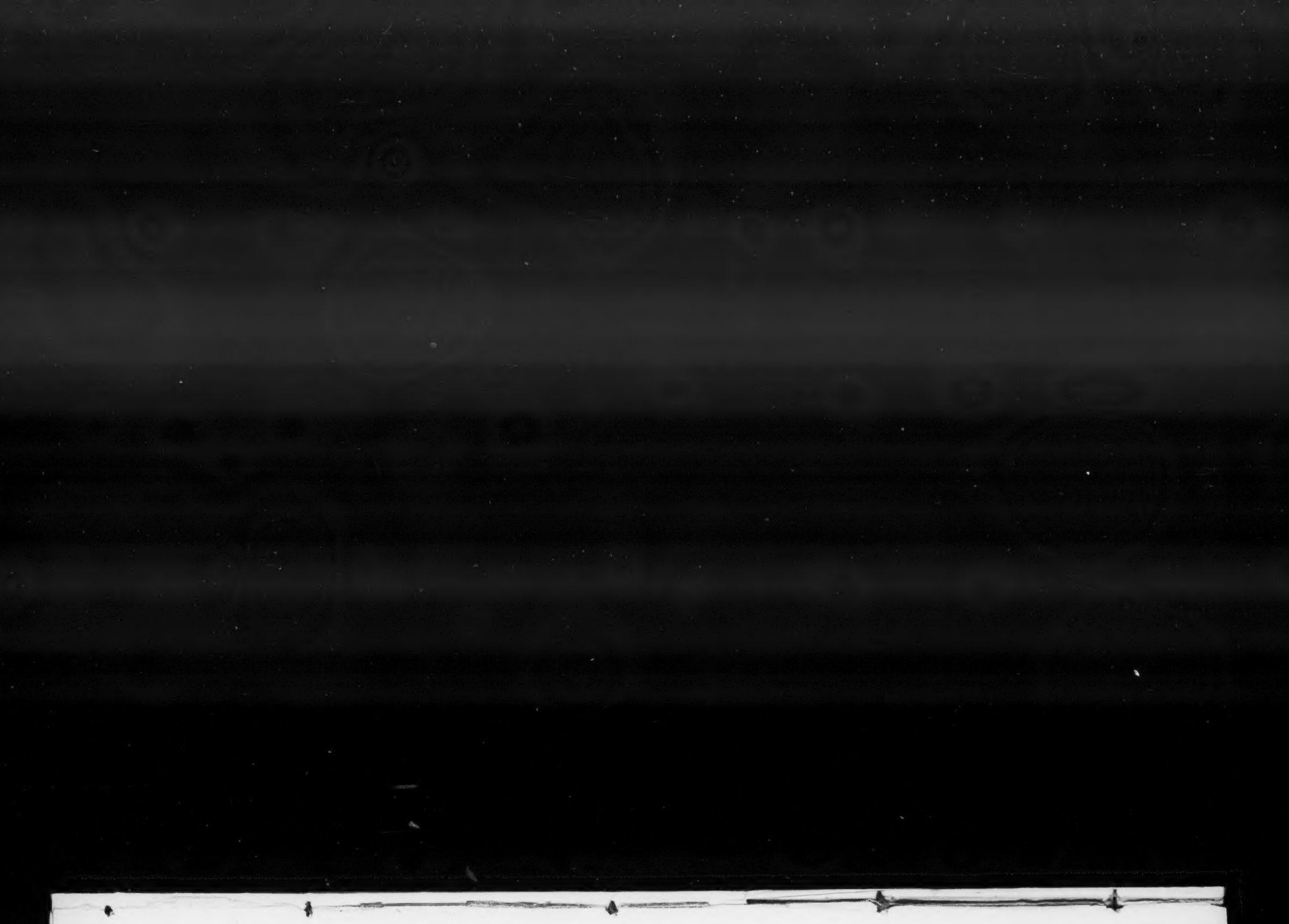
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